



More skills ... more opportunities

Essential Skills Manual

Refrigeration and Air Conditioning Mechanic

NOC 7313

REFRIGERATION AND AIR CONDITIONING MECHANIC MANUAL CONTENTS

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ABOUT TRADE ESSENTIALS

Trade Essentials is a research project funded under the Pan-Canadian Innovations Initiative, Human Resources and Skills Development Canada, in partnership with the Apprenticeship Section of the PEI Department of Innovation and Advanced Learning.

The Trades Essentials program was designed to increase participation in trades by providing a well-defined pathway for each client to build on present skills and access services necessary for success in his or her occupation.

This new concept, focusing on essential skills and recognition of prior learning (RPL), provides assessment, interventions and coordination of services for clients. This is the first project to provide a seamless learning path to trades certification.

To create this path, a number of educational tools were created and tested for thirteen trades. These tools are available in both official languages for use in any jurisdiction.

The Tools:

- Trade Specific Essential Skills Inventories (ESI)

Through a dynamic assessment process using contextualized Essential Skills assessments, clients can identify individual proficiency levels of the following Essential Skills: reading text, document use, numeracy, oral communication, writing and using computers.

The Essential Skills Inventory and the Technical Skills Inventory assist the client to develop a learning path which includes measurable targets to reach his/her individual goals.

- Trade Specific Essential Skills Curriculum

Trade specific curriculum frameworks have been created for each of the thirteen trades along with trades specific curriculum guidelines and suggested resource materials.

- Technical Skills Inventories (TSI)

Through a self assessment process, clients are able to identify their individual trade specific skills.

The Thirteen Trades:

Automotive Service Technician - Cabinet Maker – Carpenter - Construction Electrician – Cook - Industrial Electrician – Machinist - Metal Fabricator - Oil Burner Mechanic - Plumber - Refrigeration and Air Conditioning Mechanic - Steamfitter/Pipefitter - Welder

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This project is the result of the collaboration of the following dedicated adult educational consultants in Prince Edward Island:

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Karen Chandler
Gaelyne MacAulay
Karen Dempsey.

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All Trade Essentials materials have been validated by teams of tradespeople who hold Certificates of Qualification, Red Seal Endorsement. We gratefully acknowledge the crucial contribution made by the following team members:

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Ryan Rogerson (Carpenter)
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Mark Seaman (Construction Electrician)

Ken Zakem (Cook)
Rod Lukeman (Cook)
Barry Strongman (Industrial Electrician)
Gregg Francis (Industrial Electrician)
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Sue LeFort (Machinist)
John Hebert (Metal Fabricator / Welder)
Joe Johnson (Metal Fabricator)
Jim Arsenault (Metal Fabricator)
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APPENDIX A - FORMS

APPENDIX B – EXTRA INFORMATION

GLOSSARY

The definitions are intended as a guide for the language used in the Essential Skills Inventories.

ABE	Adult Basic Education
Apprentice	For the purpose of this Guide, apprentice is an inclusive term that refers to anyone working in a trade except those already certified.
Authentic workplace documents	Actual documents obtained from an employer that may be used as teaching tools. An example document is a Material Safety Data Sheet (MSDS).
Block Release Training	A period of in-school training for apprentices. It may also be referred to as Period Training or a Level.
Dynamic (interactive) Assessment	A flexible, holistic, context-sensitive approach used to evaluate learning.
Essential Skills	The set of nine skills defined by Human Resources and Skills Development Canada as being common to all occupations. The skills are: reading text (technical language), document use, numeracy (math), oral communication, writing, computer use, thinking skills, continuous learning and working with others.
Essential Skills Profile	A document that describes how each Essential Skill is used by an occupational group.
GED	General Education Diploma; a Grade 12 equivalency for adults.
Grade 12	A diploma issued by a provincial or territorial government that recognizes completion of High School. It is a challenge to use this as a common credential, since there are several different Grade 12 diplomas.

ESSENTIAL SKILLS INVENTORY ASSESSOR'S GUIDE

Intervention	For the purpose of this Guide, intervention refers to a trade-specific Essential Skills program delivered to either a group or an individual.
Journeyperson	A person who holds a Certificate of Qualification in a designated trade. A certified journeyperson is allowed to train and mentor apprentices.
Red Seal	A seal of endorsement applied to a Certification of Qualification for a trade. It allows for mobility among provinces and territories. A certified journeyperson is allowed to train and mentor apprentices.
Trade Essentials	A three-year research project to develop Essential Skills and Prior Learning assessments and curricula specific to 13 trades and to pilot the materials with six of those trades. The 13 trades included in this project were: Automotive Service Technician, Carpenter, Cabinetmaker, Cook, Construction Electrician, Industrial Electrician, Machinist, Metal Fabricator, Oil Burner Mechanic, Plumber, Refrigeration and Air Conditioning Mechanic, Steamfitter/Pipefitter and Welder. Materials were piloted with Carpenters, Steamfitter/Pipefitters, Welders, Automotive Service Technicians, Plumbers and Cooks.

1 SECTION 1

1.1 Introduction

The Essential Skills Inventories include:

- reading text
- document use
- numeracy
- oral communication
- computer use
- writing

The Essential Skills Inventories were developed during a three-year Trade Essentials project whose mandate was to develop Essential Skills assessments and curricula for 13 trades. These materials provide an opportunity for tradespeople to identify and update the Essential Skills required for their respective trades as an important step towards successful trade certification. The Essential Skills Inventory is a tool used to identify both strengths and weaknesses in trade-specific Essential Skills profiles.

2 SECTION 2

2.1 Interactive Assessment

Essential Skills Inventories:

Automotive Service Technician	7321
Carpenter	7271
Cabinetmaker	7272
Cook	6242
Construction Electrician	7241
Industrial Electrician	7242
Machinist	7231
Metal Fabricator	7263
Oil Burner Mechanic	7331
Plumber	7251
Refrigeration and Air Conditioning Mechanic	7313
Steamfitter/Pipefitter	7252
Welder	7265

Adult learners have different needs than “traditional” students so strategies must be developed to engage, motivate and build their confidence.

The Essential Skills Inventories use an innovative, interactive (dynamic) approach to assessment that is both client-centred and asset-based. An asset-based approach compares the apprentices’ present Essential Skills to the skills needed for their trade, connecting what they already know with what they need to learn.

The Inventory is a process more than a product and requires skilled and experienced assessors to establish an atmosphere where apprentices are comfortable enough to think about and explore their learning in an Essential Skills context. **Assessors need the “inner technology” to be sensitive to the needs of the apprentice and to know when to stop an Essential Skills Inventory if the apprentice is struggling.** The interactive assessment explores not only what the apprentice knows and can do, but also, gives an awareness of how the apprentice learns.

This type of assessment can be used in a pre- and post-format but cannot be referred to normative tables for interpretation. It is designed as a starting point for instruction in Essential Skills for the trades.

By using the trade-specific Essential Skills Inventory you can help an apprentice identify those skills to be updated by building upon the skills he/she already has. This process provides immediate, individual feedback to the learner. This is an assessment used *for* learning, not *of* learning.

Motivation is fundamental to change and this process helps an apprentice become motivated, engaged and confident in learning. Confidence can never be disconnected from skills. However, the apprentice does need to have a readiness, willingness and an ability to learn in order to be successful. In addition, many adults fear returning to a structured learning environment after a lengthy absence. It is very difficult to discover the learning needs of adults without the creation of a "safe environment". This is even more evident with those who have the greatest learning needs.

We need assessment and training so the workforce has the required Essential Skills to adapt to changing demands.

Why do apprentices need to go through this process?

At present, there is neither a process nor a place for those who are already working in a trade to update their trade-related Essential Skills other than completing Block training. Awareness of the trade-specific Essential Skills and the knowledge of the scope of a trade is a starting point on the path to certification. Individual assessments (inventories) followed by appropriate interventions (supports) provide the opportunity for eventual certification in the trade. The objective of this process is to help apprentices be successful in passing certification exams whether they be Block or Interprovincial Red Seal exams.

2.2 Adult Education

It is very important to be mindful of both the principles of Adult Education and the characteristics of adult learners.

2.2.1 Principles of Adult Education ¹

- ***Adults must want to learn.***
Trade Essentials clients have stated the primary reason for participating in an Essential Skills program and

¹ Adapted from www.literacy.ca, *Movement for Canadian Literacy, Principles of Adult Education*

obtaining certification was personal satisfaction, not job mobility or an increase in pay.

- ***Adults will learn only what they believe they need to learn.***

They have a practical approach to learning as they need to know how this learning affects them now.

- ***Adults learn by doing.***

Ninety-eight percent of the apprentices in the Trade Essentials Project identified their preferred learning style as kinesthetic.

- ***Adult learning focuses on problems and the problems must be realistic.***

The Essential Skills Inventories use trade-specific materials and focus on the apprentice's ability to solve problems since that is the nature of their jobs.

- ***Experience affects adult learning.***

All apprentices bring a varied background of acquired skills and knowledge together with an attitude about learning.

- ***Adults learn best in an informal situation.***

Many of the apprentices indicated they appreciate the opportunity to learn with their peers at a time convenient to them (evenings, Saturdays) and in a setting where they are comfortable sharing their knowledge with others. For the first time, there is a place dedicated to apprentices where they can access the information and the support they need.

- ***Adults want guidance.***

While experienced in their individual trades, apprentices may need help to create a learning plan to meet their objective.

2.2.2 Characteristics of Adult Learners ²

- ***Adult students are mature people and prefer to be treated as such.*** Being "lectured at" can cause resentment and frustration. Apprentices are usually kinesthetic learners and need to be active when

² Adapted from www.assetproject.info. *Learner Centred Methodologies*, Wynne, R.

learning. They also learn from each other in a classroom setting.

- ***Adults are goal/relevancy-oriented.*** Adults need to know why they are learning because their needs are concrete and immediate. They will be more interested in theory if it links to practical application.
- ***Adults may have insufficient confidence.*** A number of apprentices *may* have had prior experiences within the education system that have led to feelings of inadequacy, fear of study and failure. Many apprentices have been out of a formal learning situation for 20 years or more. Returning to a classroom environment can be daunting and challenging.
- ***Adults are often tired when they come to class as they are juggling work, family and other responsibilities.*** Most apprentices are working full time and are attending a program in the evenings and on occasional Saturdays. Many drive considerable distances, as well as driving in winter conditions.
- ***Adults learn best when they are ready to learn and when they have identified their own learning needs as opposed to being controlled by someone else.*** They want to choose options based on their own needs. Providing the apprentices with a chance to self-assess and identify their strengths and weaknesses is an important first step.

Adults learn at different rates and in various ways according to their learning styles, educational levels, experiences and relationships. The first section of the ESI is a Learning Styles Inventory. Most apprentices have never identified their own learning styles and this is often an “aha” moment for them. Being able to use this information for learning and studying techniques is invaluable to them.

- ***Adults have accumulated life/work experiences.*** They tend to favour learning that draws on their prior skills and knowledge. The Essential Skills Inventory is an assessment *for* learning, providing an opportunity for each apprentice to realize what he/she already knows and to move forward from that base. The Essential Skills Inventory identifies skills in need of updating using in-context materials and a guided self-

assessment. The skills may have been learned in a formal setting or on the job.

3 SECTION 3

3.1 The Essential Skills Inventory

Conducted in a manner that engages the apprentice and helps build confidence, the completed Inventory provides a picture of the apprentice's learning needs while recognizing the skills that have already been acquired. The Inventory is as much a process as a product. The time required to complete an Inventory will vary depending on the apprentice but should be completed in one and a half to two hours. Six of the nine Essential Skills are assessed in these Inventories and are in this order: reading text (technical language), document use, numeracy, oral communication, computer use and writing. The Inventory is divided into sections and the section questions are ordered from simple to complex.

3.1.1 Process

Sit *beside*, not across from, the apprentice as a table or desk impedes good communication and can be interpreted as one person being in a position of authority over another. If a round table is available, use it. Apprentices are not often asked to self assess, but will do so willingly if they are comfortable with the assessor and understand the process.

3.1.2 Essential Skills Profiles

The concept of Essential Skills and Essential Skills Profiles will likely be new to the apprentice. At the beginning of the interview therefore, introduce the trade-specific Essential Skills Profile. Give the apprentice a hard copy of the profile to take away with him/her. Encourage a thorough review of the profile as well as the Essential Skills website (www.hrsdc.gc.ca/essentialskills) for additional information.

*Knowledge is knowing ...
or knowing where to
find out.*

- Alvin Toffler

When introducing the profile, include these points:

- The profiles are Canadian. They were developed by interviewing fellow tradespersons, supervisors, managers and researchers in workplaces across the country.

ESSENTIAL SKILLS INVENTORY ASSESSOR'S GUIDE

- Over 350 occupational profiles are available on the website with development ongoing for additional profiles.
- Nine skills are identified as core skills common to all occupations. (The Trade Essentials Project developed learning materials for six of the nine Essential Skills).
- The Essential Skills are used in different ways and at different degrees of complexity, depending on the occupation.
- The complexity levels have nothing to do with Grade levels; they refer to the degree of difficulty of tasks completed at work. A scale of 1-5 is used for complexity levels and, even though there is a range in complexity levels, one must be able to complete tasks at the most complex level.

Gather the supplies you need prior to beginning the Essential Skills Inventory:

- *scientific calculator*
- *pencils and an eraser*
- *intake form*
- *skills summary form*
- *ESI printed on coloured paper*
- *Answer Key*

It is important to keep this discussion brief and framed in a positive manner. Adults do not want to spend time re-learning what they already know so it is helpful to give examples of the advantages of using the profile. Suggestions are: a) a plumbing apprentice may not ever need to know how to solve quadratic equations but will need to be very good at measurement and calculations for such uses as determining grade, elevation and slope, b) an apprentice may not have to read an entire operating manual but will need to find and use specific pieces of information from the manual, c) an apprentice will have to be very accurate when completing an incident or an accident report but will not be required to write an essay. The writing, in this instance, does not have to be long or complicated but it does need to be accurate and precise. It is important to make the connections between what they have learned in a more "academic" setting and how to apply those skills in a work setting.

3.1.3 Preparation

Print the apprentice's copy of the ES Inventory on light-coloured paper, preferably beige, as it reflects less light than white paper so is easier to read; the black print actually is clearer on a pastel background. The font used is Verdana, a sans serif font, 11 point, which is slightly easier to read than a serif font; 11 point is also easier to read than a smaller font.

The rationale for this formatting is that there is a need to provide equal opportunity for all apprentices without compromising standards. No two learners (apprentices) are the same. There is a possibility that an apprentice could have a learning disability and unless the apprentice has disclosed that information or provided documentation, you do not know who is at risk. Using standard formatting does not give an advantage to anyone.

Before you begin the actual Inventory, it is very important to explain to the apprentice that you will complete the Skills Summary Form as the assessment proceeds and you will give him/her a copy at the end of the interview. This avoids any discomfort that would be caused if the apprentice does not know why you are recording information during the Inventory. It is important to provide immediate feedback from the Inventory so the apprentice has a picture of the Essential Skills he/she needs to update. This also helps to mitigate anxiety prior to beginning an intervention.

Before you begin an Inventory, be sure to have these items:

- Two copies of the trade-specific **Essential Skills Profile** (one for the apprentice and one for you).
- Appropriate forms. You will need copies of the **Intake Form** and the **Skills Summary Form** (find samples in Appendix A).
- A copy of the **Essential Skills Inventory printed on pastel-coloured paper**, preferably beige or buff. You may want to work from a single copy with the apprentice or have a separate copy for yourself. Do whatever is comfortable for you and the apprentice.
- A copy of the **Answer Key**.
- A **pencil and an eraser**.
- A **basic scientific calculator**.

Although an apprentice may use a programmable or trade-specific calculator on the worksite, these types of calculators *cannot* be used when writing a Block or an Interprovincial exam. However, the prudent use of a basic scientific calculator should be encouraged while completing the Essential Skills Inventory. (One suggestion is the Casio FX-260 Solar.) A calculator is also a time saver on the job which results in increased efficiency and cost savings. Therefore the apprentice needs to be very familiar with its use. For anyone with a learning disability, the calculator can be a particularly helpful tool. The use of a calculator does

not, however, preclude the apprentice's ability to understand mathematical concepts and to estimate reasonable answers.

3.1.4 Sections of the Inventory

3.1.4.1 Learning Styles

Briefly explain the concept of learning styles (refer to Appendix B for more information). Then ask the apprentice to read each of the statements in the Inventory relatively quickly. Tell him/her to check any statements that are true personally, all or most of the time. It is best for the apprentice to go with a first reaction to the statement rather than to spend too much time thinking about it. If a statement does not apply, it is to be left blank. If there are *three or more* checks in one category, that indicates a preferred learning style. A pattern will emerge from the answers; most apprentices will have more than one learning style.

Follow the same instructions for the section on learning in a group or learning alone. This is important information for the apprentice and for the instructor.

3.1.4.2 Technical Language (Reading text)

This section begins with lists of words that are contextualized to the trade and have been taken from either the Essential Skills Profile (ESP) or the National Occupational Analysis (NOA) glossary. The lists are arranged in order from simple to complex, each list containing ten words.

Ask the apprentice to choose a list he/she would be comfortable reading aloud. As long as the apprentice has *seven out of ten* words correct in any list, ask him/her to continue reading aloud as far as possible with the lists. Some apprentices will begin reading at a lower level and continue to the end of list four; others will read list four on the first try. It is important for the apprentice to begin reading at a point of comfort and to proceed from there. *If an apprentice struggles with the first list, stop there.* Use the list to indicate a beginning point for the technical reading excerpts. For example, if an apprentice reads six out of ten words (less than seven) in list three, refer to section two in the reading. ***A crucial aspect of the technical reading is to know when to stop if the apprentice is struggling***

The Essential Skills Inventory provides a wealth of information about the apprentices and their learning.

with a skill. This is one of the most important skills for you to have as an assessor, that is, to be sensitive and responsive to the needs of each apprentice.

Before using the reading excerpts, ask each apprentice to read the list of pseudowords (nonsense words). Explain the reason for using this list; that decoding words is an important reading skill for comprehension, speed and fluency. If the apprentice struggles with this list and cannot read most of the words, this is a warning that the apprentice may have reading difficulties.

The reading excerpts consist of trade-related materials. A readability index has been completed on each passage as a guide for the difficulty of the reading. Give the apprentice the appropriate reading. Ask him/her to read the questions first, then find the answers to the questions from the excerpt. Explain that the answers to certain questions are not direct matches of information but require “reading between the lines” to find the answer. The questions have been intentionally placed at the beginning of the reading to help the apprentice become a “directed” reader.

Record the section(s) with which the apprentice experiences difficulty (if any). While the reading is not timed, you will want to record if an apprentice takes an exceptionally long time to answer the questions. All apprentices need to be able to read and understand at a post-secondary level (level 3) if they are to be able to confidently use materials at work and to keep pace with workplace changes.

If the apprentice does not need to update reading skills, complete the Skills Summary Form with “No updating required”. If the apprentice has difficulty answering any questions in a particular section, record the Section Number on the Skills Summary Form.

3.1.4.3 Document Use

The document use sections contain information that is presented in a format other than text. There may be charts, graphs, tables, schematics and/or blueprints that are trade-related. There is always a question taken from the National Occupational Analysis (NOA), in the form of a pie chart that explains the construction of the Interprovincial (Red Seal) exam and the percentage of questions on each topic (block) for the particular trade. This question not only indicates if

the apprentice can find and use information from a pie chart but also gives you, the assessor, the opportunity to give a brief explanation of the exam format and the scope of the specific trade.

Record the Section and **the type of document** with which an apprentice experiences difficulty. If there is no apparent difficulty, record "No updating required".

3.1.4.4 Numeracy

The numeracy sections are arranged from simple to complex and are based on the Math Skills Summary identified in the Essential Skills Profile for each trade. Not all skills are included for the sake of brevity of the Inventory but enough are included to give an instructor a picture of the skills of the apprentices. There is a *Math Legend* included in each Inventory that identifies the math concept illustrated by each question. Refer to this as you proceed through the Inventory and record the skills needing updates on the Skills Summary Sheet.

Section 1 (S-1) begins with using whole numbers. It is important to have a place for the apprentice to begin where he/she is comfortable and confident and then proceed to more difficult concepts. The apprentice will likely choose to skip the work with whole numbers. An apprentice does not have to write the answers to all the questions as this is often far too time-consuming. You can decide to ask the apprentice *how* to find the answer. *The process is as important as the product.* Stop Inventory if the apprentice is struggling. The numeracy sections take the most amount of time when completing an Inventory.

Record the section number and the concepts the apprentice needs to update. This information will be required by both the apprentice and the instructor or tutor; it will also be used for a post-inventory after instruction or self-study has occurred. If your apprentice can answer all the questions, record "No updating required".

3.1.4.5 Oral Communication

There are two parts to the Oral Communication section of the Essential Skills Inventory. The Speaking Skills Rating Scale is to be completed by you, the assessor; the other is a self-assessment completed by the apprentice. After having

spent one and a half to two hours with the apprentice, you will be able to complete most sections of the scale. If not, document a particular skill as “not assessed” or “not applicable”. The remaining questions are taken directly from the Essential Skills Profile for the trade. The questions (tasks) are arranged in order from simple to complex. The self-assessment scale mirrors the stages of learning or skill building, that is, “needs help”, “can do alone” and “can help an apprentice”. This is an opportune time to mention the fact that it is a responsibility of being a journeyperson to mentor other apprentices.

If the journeyperson indicates he/she cannot help an apprentice, record that updating is required.

3.1.4.6 Computer Use

The questions in the Computer Use section may reflect the information in the trade-specific Essential Skills Profile or may go beyond that profile. In a knowledge-based economy, it is realistic to expect a certain level of computer literacy regardless of the trade in which one is employed. The Computer Use questions reflect the basic skills required. Changes in technology will continue to occur rapidly so it is critical to have at least a basic knowledge of computer use.

Record the skills to be updated. If there are no needs identified, record “No updating required”.

3.1.4.7 Writing

The first questions in the writing section are examples taken directly from the Essential Skills profile and range in difficulty from simple to complex. The scale used reflects the stages of learning: “needs help”, “can do alone”, and “can help an apprentice”. One additional question pertains to the preparation of a resumé, a skill required by all tradespersons.

The last question is a writing sample and is common to all the Inventories. The writing sample provides an opportunity for you to observe if the apprentice is able to:

- use cursive writing (as compared to printing)
- write legibly
- complete the activity with ease or struggle to write a sentence or two

- put thoughts on paper in a logical order
- use punctuation correctly
- spell correctly
- use correct grammar

Record on the Skills Summary Form areas in need of updating, or use "No updating required".

4 SECTION 4

4.1 Essential Skills Inventory Records

*Education is what remains
after one has forgotten
what has been learned at
school.*

- Albert Einstein

You will have completed the Skills Summary form by the end of the Inventory. Using this process as a means of learning the apprentice's strengths and weaknesses provides an opportunity to give each apprentice immediate, individual and confidential feedback about his/her Essential Skills needs. Inform the apprentice that a copy will go to an instructor or a tutor if an Essential Skills intervention is planned. Both the apprentice and the instructor are then cognizant of the Essential Skills needs of each apprentice.

The information from the Skills Summary can be summarized in graph form (bar graph recommended) individually, or as a group dependent on specific needs. It is also helpful for an instructor to have an accompanying narrative.

5 SECTION 5

5.1 Essential Skills Post-Inventory

5.1.1 Post-Inventory Directions

The post-inventory will be different for each apprentice dependent upon his/her learning needs as identified in the original ES Inventory. Only the skills that were to be updated are used to create the post-inventory. There is a scale used to indicate an apprentice's improvement or mastery of the skills. This post-inventory can be used at a time determined either by the instructor or after a specific number of intervention hours.

The administrative directions for the post-inventory are that it is to be given under standard test conditions, that is, each

apprentice is to complete the inventory independently and without assistance. The time required for each post-inventory will vary, but each apprentice must be allowed the time required for completion.

5.1.2 Post-Inventory Reporting Form

See Appendix A for a sample Post-Inventory form.

APPENDIX A

FORMS

**ESSENTIAL SKILLS INVENTORY
INTAKE FORM**

DATE: _____		TIME IN: _____	
TRADE: _____		TIME OUT: _____	
1.	NAME: Last _____	First _____	Middle _____
2.	Mailing Address: _____ _____ _____ _____		Email Address: _____ _____
3.	PHONE: Home _____	Work _____	Cell _____
4.	Who is your present employer? _____		
5.	Have you registered as an apprentice?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
6.	Do you have experience in other trades:	<input type="checkbox"/> YES	<input type="checkbox"/> NO
7.	What school did you attend? (be sure to document if they have Grade 12)	_____ _____	When? _____
8.	How long have you been out of school? _____		
9.	What other training have you taken? _____		
If you have written the Red Seal exam before, continue with questions 10 and 11. If you have not written the exam before, please skip to question 12.			
10.	When did you write the Red Seal exam? _____		
11.	What difficulties did you have with the exam? _____ _____		
12.	Why do you want to write the Red Seal exam? _____ _____		

ESSENTIAL SKILLS INVENTORY
INTAKE FORM

13.	Which Essential Skills updating programs do you believe will be most helpful for you?
14.	What would be the best time for you to attend a program?
	Days of the week? _____
	Time of Day? _____
	Months? _____
15.	How did you hear about this program?

NOTES:

NAME: _____

TRADE: _____

DATE: _____

Having completed the Essential Skills Inventory for your trade, this summary outlines which Essential Skills you need to update as you continue on your chosen career path.

	Auditory (hearing)	Visual (seeing)	Kinesthetic (doing)	Group	Alone
Learning Style					

1. Technical Reading _____

2. Document Use _____

3. Numeracy _____

3.1 Scientific Calculator YES _____ NO _____

4. Oral Communication _____

5. Computer Use _____

6. Writing _____

 Interviewer

Essential Skills Post Inventories

The results of the Essential Skills Inventories, completed by each of your apprentices prior to the beginning of your program, indicated the Essential Skills in need of updating for each apprentice.

To track each apprentice's progress, it is now time to complete a post-inventory of those same skills.

Please administer the Post-Inventory as a "test", that is, each apprentice is to complete the Inventory *without any help*. **Ask each apprentice to complete only the questions that are marked.** The time required will vary for each apprentice as each post-inventory is different; therefore please give each apprentice the time needed to complete the inventory. Upon completion, return the Inventories to Trade Essentials (with your program coordinator). The results will be returned to you to share with your apprentices. This will be one indication of each apprentice's readiness to challenge an exam whether it be the IP Red Seal exam or block exam.

If you have any questions, please contact the Trade Essentials office at 620-3623.

Thanks in advance for your cooperation.

NAME:

TRADE:

DATE:

INSTRUCTOR:

Upon completion of the Essential Skills Inventory prior to the beginning of the program, your Essential Skills Summary indicated that you would benefit from instruction in the Essential Skills shown in the chart below as you prepare for licensing in your trade.

The results of the Post Inventory indicate which of your Essential Skills have improved, which need further development and those that appear to meet trade requirements. Please note that "meets trade Essential Skill requirement" means that you had the correct response to *each* question.

	Shows Improvement	Needs further development	Meets trade Essential Skill requirement
Technical Reading			
➤ Section 1			
➤ Section 2			
➤ Section 3			
➤ Section 4			
Document Use			
➤ Section 1			
➤ Section 2			
➤ Section 3			
➤ Section 4			
Numeracy			
➤ Section 1			
➤ Section 2			
➤ Section 3			
➤ Section 4			

APPENDIX B

EXTRA INFORMATION

The following information is provided as supplemental information for you the interviewer. Because the Essential Skills initial interview is a dynamic assessment involving your input and possible responses to the apprentice, you may need/want additional reference material on both Learning Styles and the Essential Skills required for the various trades.

Learning style refers to the way an individual processes information, that is, the way a person learns best. Most people tend to use one sense more than the other. However, a number of people may learn equally well regardless of how information is presented to them. Knowing your learning style is an important key to improving success in a classroom and on exams.

It is important to know *how* one learns, not just *what* one needs to learn. Completion of the Learning Styles section at the beginning of the Essential Skills Inventory will help the apprentice discover his/her learning style. This can often be an “Aha” moment for the apprentice as s/he may not have had access to this information. The learner can then reflect on, gather, or be provided with information about the study and learning techniques suited to his/her individual learning style. This knowledge should contribute to an improvement in the quality and speed of learning.

There are basically three learning styles preferences: auditory (hearing), visual (seeing), and kinesthetic (doing, experiencing).

Visual learners are those who learn best by seeing things. A visual learner may display these characteristics:

- good at spelling but may forget names
- needs quiet time to study
- needs time to think before understanding a lecture
- understands/likes charts
- good with sign language

Auditory learners are those who learn best by hearing things. An auditory learner may display these characteristics:

- not afraid to speak in a group/class
- likes to read aloud to him/herself
- likes oral reports
- good at explaining
- remembers names
- enjoys music
- good at grammar and foreign languages
- may read slowly
- follows spoken directions well
- good in study groups
- finds it difficult to stay quiet for long periods

Kinesthetic learners are those who learn by experiencing /doing things. A kinesthetic learner is one who:

- can't sit still for long
- may be good at sports
- may not have great handwriting
- likes role playing
- studies with music playing
- takes breaks when studying
- fidgets during lectures

(Adapted from <http://homeworktips.about.com>)

Suggested strategies for studying /learning are:

Auditory	Visual	Kinesthetic
Listen to instructions and information orally	Watch for key words to summarize points	Ask questions and participate in discussions whenever possible
Sit towards the front of the room	Complete readings before class	Do something physical before sitting down to study
Repeat information silently to yourself	Use visuals like symbols and color in notes	Break reading tasks into small chunks
Work in quiet areas	Write down what you hear	Highlight, underline or take notes
Tape important information	Ask for other visual information	Take regular brief breaks to move around
Use rhymes or jingles to summarize important points	Try to remember important terminology by looking for parts of words already known	Break reading into chunks and write brief summaries
Create verbal descriptions	Color code notes	

(Adapted from The University of Western Ontario, Student Development Centre)

Note : There are many Learning Style Inventories available, some of which can be completed on line. These sites may also provide strategies for learning for each Learning Style.

Suggestions are:

www.vark-learn.com

<http://homeworks.about.com>

www.sdc.uwo.ca

pi (π) = 3.1415926535 ...

Perimeter formula

Square	$4 * \text{side}$
Rectangle	$2 * (\text{length} + \text{width})$
Parallelogram	$2 * (\text{side1} + \text{side2})$
Triangle	$\text{side1} + \text{side2} + \text{side3}$
Regular n-polygon	$n * \text{side}$
Trapezoid	$\text{height} * (\text{base1} + \text{base2}) / 2$
Trapezoid	$\text{base1} + \text{base2} + \text{height} * [\csc(\text{theta1}) + \csc(\text{theta2})]$
Circle	$2 * \pi * \text{radius}$
Ellipse	$4 * \text{radius1} * E(k, \pi/2)$ E(k, $\pi/2$) is the Complete Elliptic Integral of the Second Kind $k = (1/\text{radius1}) * \sqrt{\text{radius1}^2 - \text{radius2}^2}$

Area formula

Square	side^2
Rectangle	$\text{length} * \text{width}$
Parallelogram	$\text{base} * \text{height}$
Triangle	$\text{base} * \text{height} / 2$
Regular n-polygon	$(1/4) * n * \text{side}^2 * \cot(\pi/n)$
Trapezoid	$\text{height} * (\text{base1} + \text{base2}) / 2$
Circle	$\pi * \text{radius}^2$
Ellipse	$\pi * \text{radius1} * \text{radius2}$
Cube (surface)	$6 * \text{side}^2$
Sphere (surface)	$4 * \pi * \text{radius}^2$
Cylinder (surface of side)	$\text{perimeter of circle} * \text{height} = 2 * \pi * \text{radius} * \text{height}$
Cylinder (whole surface)	Areas of top and bottom circles + Area of the side
	$2(\pi * \text{radius}^2) + 2 * \pi * \text{radius} * \text{height}$
Cone (surface)	$\pi * \text{radius} * \text{side}$
Torus (surface)	$\pi^2 * (\text{radius2}^2 - \text{radius1}^2)$

Volume formula

Cube	side^3
Rectangular Prism	$\text{side1} * \text{side2} * \text{side3}$
Sphere	$(4/3) * \pi * \text{radius}^3$
Ellipsoid	$(4/3) * \pi * \text{radius1} * \text{radius2} * \text{radius3}$
Cylinder	$\pi * \text{radius}^2 * \text{height}$
Cone	$(1/3) * \pi * \text{radius}^2 * \text{height}$
Pyramid	$(1/3) * (\text{base area}) * \text{height}$
Torus	$(1/4) * \pi^2 * (r1 + r2) * (r1 - r2)^2$

METRIC PREFIX IN ELECTRONICS

Multiplication Factor	Prefix	Symbol
$1,000,000,000,000,000,000 = 10^{18}$	exa	E
$1,000,000,000,000,000 = 10^{15}$	peta	P
$1,000,000,000,000 = 10^{12}$	tera	T
$1,000,000,000 = 10^9$	giga	G
$1,000,000 = 10^6$	mega	M
$1,000 = 10^3$	kilo	k
$100 = 10^2$	hecto	h
$10 = 10^1$	deka	da
$0.1 = 10^{-1}$	deci	d
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000\ 001 = 10^{-6}$	micro	μ
$0.000,000,001 = 10^{-9}$	nano	n
$0.000,000,000,001 = 10^{-12}$	pico	p
$0.000,000,000,000,001 = 10^{-15}$	femto	f
$0.000,000,000,000,000,001 = 10^{-18}$	atto	a

Example: $1500\text{ Hz} = 1.5\text{ kHz} = 1.5\text{ kilohertz} = 1.5 \times 10^3\text{ Hz}$

Example: $0.007\text{ A} = 7\text{ mA} = 7\text{ milliamps} = 7 \times 10^{-3}\text{ Amps}$

Each different ratio has its own formula. These are shown below.

The ratio of $\frac{\text{opposite}}{\text{hypotenuse}} = \text{sine or sin}$

The ratio of $\frac{\text{adjacent}}{\text{hypotenuse}} = \text{cosine or cos}$

The ratio of $\frac{\text{opposite}}{\text{adjacent}} = \text{tangent or tan}$

NOTE

The acronyms for the three ratios are:

- Sine opposite hypotenuse – SOH
- Cosine adjacent hypotenuse – CAH
- Tangent opposite adjacent - TAS

These acronyms are extremely helpful as they can be used to write out the three different formulas and aid in solving trigonometry questions. These three formulas can be changed into three formula triangles and then it is a matter of substituting them into the formula. The three formula triangles are shown in Figure 9.

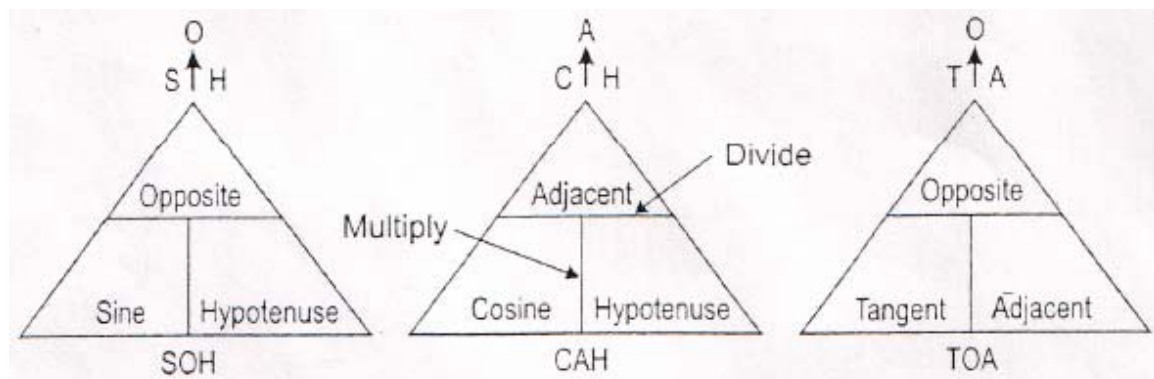


Figure 9 – Formula triangles

To use the formula triangles, cover the unknown and complete the remaining calculation. Each formula triangle can be used to construct three variations.

TABLE OF CONTENTS

REFRIGERATION AND AIR CONDITIONING MECHANIC NOC 7313

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NAME:

DATE:

LEARNING STYLES CHECKLIST**Learning by hearing (auditory)**

- ☐ I remember the things I hear better than the things I see.
- ☐ I learn better when someone explains to me how to do something better than when I follow a diagram.
- ☐ I find it easier to remember a telephone number I have heard than one I have read.
- ☐ I prefer to listen to the news on the radio than to read the newspaper.
- ☐ I remember the times tables by saying them to myself.
- ☐ After I am introduced to someone, I'm good at remembering his/her name.

Learning by seeing (visual)

- ☐ I remember what I've seen, better than what I have heard.
- ☐ I remember what happened by seeing the incident in my head.
- ☐ I remember what I hear by picturing it in my head.
- ☐ I am good at remembering faces.
- ☐ When someone says a number, I don't understand it until I see it written down.
- ☐ I can add simple numbers which are written down better than numbers that are in my head (e.g., $16+24+10+98$).
- ☐ To remember a car license number, I picture it in my head.

Learning by doing (kinesthetic)

- ☐ When I put something together, I remember how it works.
- ☐ I remember certain directions after I have done something once or twice.
- ☐ I like to do things like simple repairs where I can use my hands.
- ☐ I can learn best if the instructor uses models, experiments and other practical tools to show what he/she is talking about.
- ☐ Using concrete examples is a good way for me to improve my math or spelling skills.
- ☐ I remember telephone numbers if I've dialed them a few times.

Learning in a group

- ☐ I like learning in a group so I can discuss the work with others.
- ☐ I enjoy helping other people in the group with their work.
- ☐ If I need to do something, I don't mind asking the person next to me.

Learning Alone

- ☐ I can concentrate best if I work on my own.
- ☐ It's hard to work if people are talking around me.
- ☐ I'd be embarrassed to show my mistakes to anyone other than an instructor.
- ☐ I can't concentrate if people are moving around the room.

(Adapted from SGL Handbook, ALSO, Ottawa)

1	2	3	4
duct	coupling	decimal	efficiency
height	amperes	rotary	refrigerant
code	circuit	radiant	capacitor
width	piston	conduit	insulation
grid	system	radius	specifications
gauge	corrode	ratio	utility
weigh	safety	components	evacuation
switch	vacuum	electronic	humidity
type	micron	appliance	thermometer
check	control	requirements	micrometer

poy

meef

fesh

moyp

toof

koyth

hafe

tibe

hoysh

thoop

marp

theg

yome

zule

NAME:

DATE:

From the article below, answer the following questions.

1. How does refrigeration keep food from spoiling?

2. According to the article, how long does it take milk to spoil if left at room temperature?

3. What does "non-bacterial ways" mean?

The Purpose of Refrigeration

The main reason for having a fridge is to keep food cold. Cold helps food stay fresh longer. The basic idea behind refrigeration is to slow down the growth of bacteria (which all food contains) so that it takes longer for the bacteria to spoil the food.

For example, bacteria will spoil milk in two or three hours if the milk is left out on a table or a counter. By reducing the temperature of the milk it will stay fresh for a week or two. The cold temperature inside the fridge slows down the growth of the bacteria that much. By freezing the milk, you can stop the bacteria altogether, and the milk can last for months (until effects like freezer burn begin to spoil the milk in non-bacterial ways).

Refrigeration and freezing are two of the most common forms of food preservation used today.

<http://chinesefoodsafety.com>
FOG Index 6.4

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. What does "cemf" mean?

2. Describe how a magnetic relay is similar to a solenoid.

Current (Magnetic) Relay

Current relays are usually found on low-torque, smaller horsepower motors. The current (magnetic) relay uses the electrical characteristics of the motor to operate.

As the motor picks up speed, magnetic fields build up and collapse in the motor. This produces a counter electromotive force (cemf) or voltage on the running winding. The running winding consumes more current when the motor is not running, or is turning slowly, than it does at full speed. Current-operated relay switches are used to close and open the starting winding. They operate on the change in current flow of the running winding. This is done as the winding goes from a start condition to run.

The magnetic relay is an electromagnet much like a solenoid. Either a weight or a spring holds the starting winding contact points open when the system is idle. When the motor control (thermostat or pressurestat) contacts close, high current flows in the running winding. The magnetic current relay coil is then heavily magnetized. It lifts the weight or overcomes the spring pressure and closes the contacts.

This action closes the starting winding circuit. The motor will quickly accelerate (speed up) to two-thirds or three-fourths of the rated speed. As it does so, the amperage draw of the running winding of the motor decreases. This decreases the magnetic strength of the magnetic current delay. The decrease is enough to allow the weight or the spring to open the points.

*Modern Refrigeration and Air Conditioning, 18th Edition, Althouse, Turnquist and Bracciano
FOG Index 8.5*

NAME:

DATE:

1. Why do HCFCs have a less harmful effect on global warming than CFCs?

2. What is the advantage of using HFCs over HCFCs as refrigerants?

3. a) Which type of refrigerant is R-134a?

- b) Why is R-134a not an easy replacement for R-12?

HCFC Refrigerants

Hydrochlorofluorocarbons (HCFCs) are molecules composed of methane or ethane in combination with a halogen. This makes up a new molecule that is considered to be partially halogenated.

The HCFCs have shorter lives and cause less ozone depletion than the fully halogenated CFCs. Therefore, they have reduced potential for global warming. HCFCs such as R-22 and R-123 are considered to be interim refrigerants. They will be used until suitable replacements are available. The EPA requires the phaseout of HCFCs by the year 2030.

HFC Refrigerants

Hydrofluorocarbons (HFCs) include such refrigerants as R-134a and R-23. They are different from chlorofluorocarbons – they contain one or more hydrogen atoms and no chlorine atoms. HFCs are considered to have zero potential for ozone depletion. They have only a slight effect on global warming.

R-134a is typically used in new systems that are specifically designed for its use. The concept that R-134a is an easy replacement for R-12 is not correct,

however. When using R-134a in retrofitting a system, numerous items must be considered. (Retrofitting is the updating of an existing system to new standards.) R-134a refrigerants will not readily mix with mineral oils or alkyl-benzene lubricants. Synthetic oils must be used for lubrication of hydrofluorocarbons; existing oils must be replaced.

The use of the proper recovery unit is necessary for the removal of R-12. There are also a number of other factors to be considered. These include system performance, hardware changes and existing material and lubricant compatibility. Prior to retrofitting a system, the technician should always check with the manufacturer to be certain that it is proper.

(FOG 9.5)

Modern Refrigeration and Air Conditioning, 18th Edition, Althouse, Turnquist and Bracciano

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. What "added value" can you, as an HVAC technician, be to a company?

2. Why is it crucial to respect the customer's time?

3. For a company to be successful, does it always have to compete on price?

4. What does "systematic troubleshooting" mean to you?

Productivity

In order for companies to survive in today's market, they must be able to produce quality service or product at a reasonable profit. For that, they need employees who take pride in their work and promote the company in a positive manner. In many cases, the technician will represent the face of the company, and your actions will be the basis of the customer's opinion of the company. If you show up when expected and present yourself as a well-organized professional, the customer will be more trusting and view your professionalism as an added value. If you cannot be on time, call ahead and inform the customer of the delay. This shows respect for the customer's time.

A company with a good reputation does not have to have the lowest prices. People are willing to pay a little extra for a reputable company with a history of fair dealings. In fact, lowering bid prices to obtain work or the promise of future work is probably the worst course of action. Satisfied customer will tell a few of their friends and family members about the good service they received, but unhappy customers will tell everyone about a bad experience.

As a valued employee, you must perform your work as quickly and professionally as possible. The best way to do this is to preplan your work and use systematic troubleshooting to identify the problem, think about the job and list the steps necessary to complete it. Then select the tools needed to get the job done correctly and as quickly as possible. Systematic troubleshooting and preplanning are steps to increasing your productivity.

(FOG Index 11.2)

HVACR 101 Air Conditioning Contractors of America, Plumbing – Heating – Cooling – Contractors – National Association Educational Foundation, Refrigeration Service Engineers Society, 2009

NAME:

DATE:

The effects of solar radiation are only evident on surfaces exposed to direct rays of sun. The table below indicates the added temperature difference.

1. According to the chart, what is the difference in the solar effect between a dark surface facing west and a light west-facing surface?

2. What is the difference in the effect between a light south-facing surface and a dark south-facing surface?

3. What is the difference in the effect between a dark flat roof and a light surface facing east?

Solar Effect (Temperature Difference Allowance)

Surface	East	South	West	Flat Roof
Dark	8° F	5° F	8° F	20° F
Medium	6° F	4° F	6° F	15° F
Light	4° F	2° F	4° F	9° F

NAME: _____

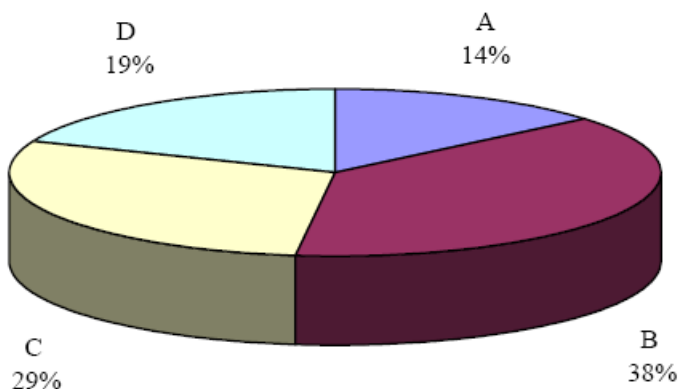
DATE: _____

The Interprovincial Red Seal exam for your trade consists of 125 multiple-choice questions. The exam topics and the percentage of questions are shown on the pie chart.

1. According to the chart, which two topics have the largest number of questions?

2. How many questions are on "Occupational Skills"?

3. How many questions in total are on sections B and C?

**TITLE OF BLOCKS**

Block A Fundamental Occupational Skills

Block C Heating, Ventilating and Air Conditioning Systems

Block B Refrigeration and Air Cooling Systems

Block D Control Systems

National Occupational Analysis 2004, Human Resources Partnership Directorate

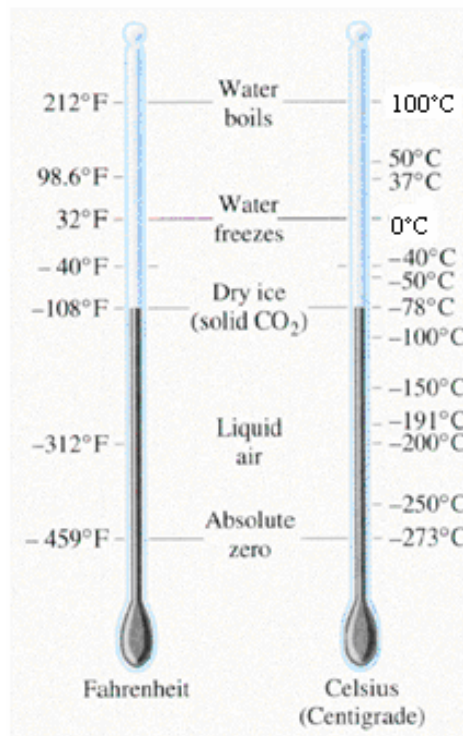
NAME: _____

DATE: _____

1. According to the Fahrenheit and Celsius temperature scales, at what temperature Celsius does water turn to steam?

2. At what temperature Celsius does water freeze?

3. At which temperature are the two scales the same?



NAME:

DATE:

1. According to the table of contents from the 2005 National Building Code, which section of the NBC code applies particularly to your trade?

Table of Contents

Volume 1

Preface

Relationship of the NBC to Standards Development and Conformity Assessment

Canadian Commission on Building and Fire Codes and Standing Committees

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- Part 2 Objectives
- Part 3 Functional Statements

Division B Acceptable Solutions

- Part 1 General
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- Part 4 Structural Design
- Part 5 Environmental Separation
- Part 6 Heating, Ventilating and Air Conditioning
- Part 7 Plumbing Services
- Part 8 Safety Measures at Construction and Demolition Sites
- Part 9 Housing and Small Buildings

Division C Administrative Provisions

- Part 1 General
- Part 2 Administrative Provisions

National Building Code of Canada, 2005, Volume 1

According to this excerpt from the National Building Code, would the following meet the required standards? If not, why not?

2. A pipe carrying water of 105° C has 10 mm clearance from the wooden floor joists.

3. A pipe carrying water of 140° C is 30 mm from a wall.

Section 6.2.9.3 Clearances

- 1) Clearances between combustible material and bare pipes carrying steam or hot water shall conform to table 6.2.9.3.

Table 6.2.9.3
Clearance Between Steam or Hot Water Pipes and Combustible Material
Forming part of Articles 6.2.7.1 and 6.2.9.3 and sentence 6.2.8.1 (2)

Steam or Water Temperature, °C	Minimum Clearance, mm
Up to 95	No clearance
Above 95 to 120	15
Above 120	25

(National Building Code of Canada, 2005, Volume 1)

NAME: _____

DATE: _____

Calculate the following:

1. $13812 \text{ mm} + 16442$ 2. $3401 \text{ in.} - 1824$ 3. $65 \text{ ft.} \times 98$ 4. $10\,024 \text{ km} \div 24$

5. $.0067 \text{ mm} + .2543$ 6. $26 \text{ g} - .03$ 7. $.034 \text{ m} \times .025$ 8. $13.25 \text{ mm} \div 25$

9. $6 \frac{2}{5} + 1 \frac{1}{5} =$ 10. $\frac{2}{3} + \frac{1}{2} =$ 11. $\frac{7}{9} - \frac{5}{9} =$ 12. $\frac{9}{5} \times \frac{7}{8} =$

13. $\frac{2}{5} \div \frac{4}{6} =$ 14. $1 \frac{1}{5} \div 2 \frac{1}{2} =$

Please give the mixed number equivalent or the improper fraction.

15. $\frac{10 \text{ mm}}{3 \text{ mm}} =$ 16. $5 \frac{7}{8} \text{ in.} =$

Write an equivalent fraction.

17. $\frac{3}{8} \text{ ft.} =$ ____ ft. 18. $\frac{2}{3} \text{ ft.} =$ ____ ft.

19. What is the total weight of these air conditioning units: $40 \frac{1}{2} \text{ lb.}$, 52 lbs. , $30 \frac{3}{4} \text{ lbs.}$?

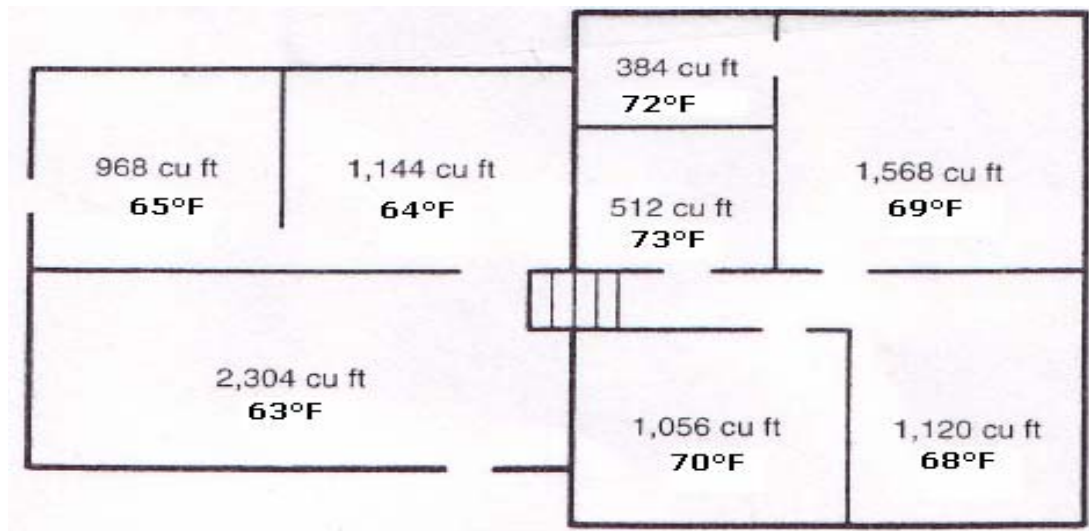
20. Complete the table below with the missing measurements:

Fractional Inch	Decimal Inch	Percent
1/64	0.015625	
	0.1875	
1/8		
1/16		
	.50	

21. At high speed, a blower delivers 2580 ft³/min. This volume is divided equally among 12 ducts. You need to know the amount of air in cubic feet that flows through each duct every minute. How would you calculate this?

22. a) What is the total volume in ft³ of this house? _____

b) What is the average room temperature? _____



23. a) You are working with a circular duct that is $7 \frac{1}{2}$ inches in diameter. You then wrap the duct with insulation that is $1 \frac{1}{8}$ inches thick. What is the diameter of the duct now?

- b) Change your answer to a decimal fraction.

NAME: _____

DATE: _____

Calculate the following:

1. $72 \div 6 + 4 \times 3^{\circ}\text{F} = \text{ }^{\circ}\text{F}$ 2. $6 (25-5) + 16 - 2(8-6)^{\circ}\text{C} = \text{ }^{\circ}\text{C}$

3. $6^3 = \text{ }$ 4. $(2/3)^3 = \text{ }$

5. $10^6 = \text{ }$ 6. $10^{-3} = \text{ }$

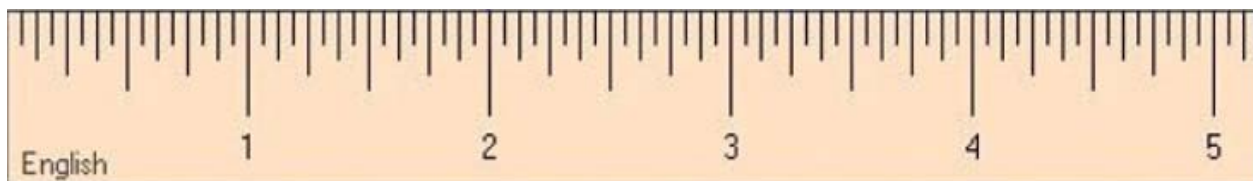
7. $12^2 = \text{ }$ 8. $(\sqrt{16})^3 = \text{ }$

9. In January, the temperature at your work site fell from $+3^{\circ}$ to -15° C during the day. How many degrees did the temperature drop?

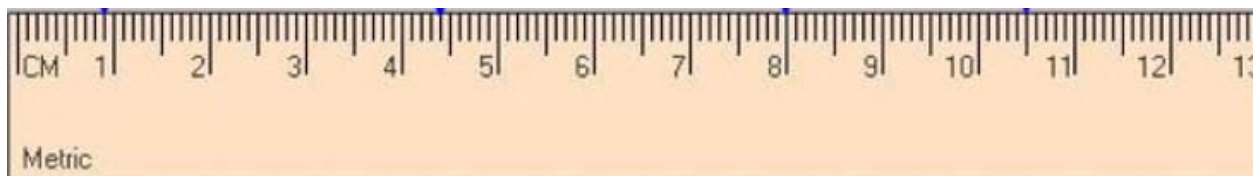
10. If the water temperature of a boiler changed from 211° F to 104° F, how many degrees of heat were lost?

11. On the steel rules below, mark 25.4 mm, $1 \frac{1}{2}$ in., $4 \frac{15}{16}$ in. and 2.54 cm.

Imperial



Metric



Convert the following measurements of length:

1 inch = 2.54 cm 1 ft = 30.48 cm	3 ft = 1 yd 1 ft = 0.3048 m	° C = (° F - 32) x 5/9 ° F = (° C x 9/5) + 32
---	--	--

12. 1.046 mm = _____ cm
13. 0.0086 mm = _____ m
14. 144 in = _____ yds
15. 0.92 km = _____ m
16. 96 in = _____ ft
17. 3.4 ft = _____ in
18. ½ in. = _____ mm
19. 7 ft. = _____ m
20. 20° F = _____ ° C
21. 31° C = _____ ° F
22. During a forty hour work week, you spend 15 % of your time driving to and from various jobs. How many hours are you driving?

23. Your company borrows money to buy new trucks. The interest paid on your loan is \$1440.00 which is actually 6% of the loan. How much money did you borrow?

24. The air in a room is completely replaced 4 times in an hour. What percent of the air is replaced in 5 minutes? (round your answer to the nearest whole percent).

25. You are installing an air conditioning system in a building under construction. The bill for the installation is the cost of the parts plus overhead plus sales tax. The overhead is 75% of the cost of the parts. The parts cost \$3500.00. The sales tax is 4% of the cost of the parts plus overhead.
 - a) How much is the overhead? _____
 - b) Calculate the sales tax. _____
 - c) What is the total amount of the bill? _____

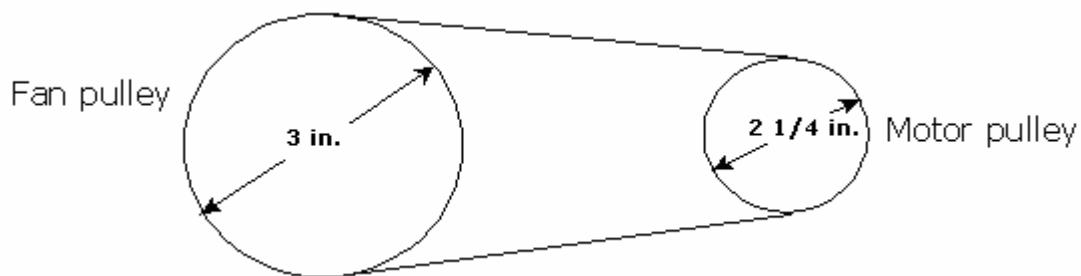
NAME: _____

DATE: _____

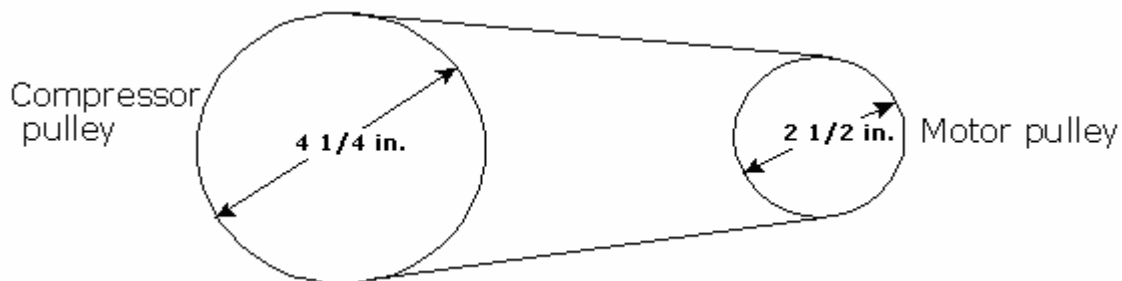
1. You are working with a refrigerant R-410 A which is a mixture of refrigerants R-32 and R-125. It takes 60 pounds of R-32 and 40 pounds of R-125 to make 100 pounds of R-410A. What is the ratio of R-32 to R-125?
- _____

When two pulleys with different diameters are connected by a belt, the rpms for each pulley are different. The ratio of the rpms is the inverse of the ratio of the pulley diameters.

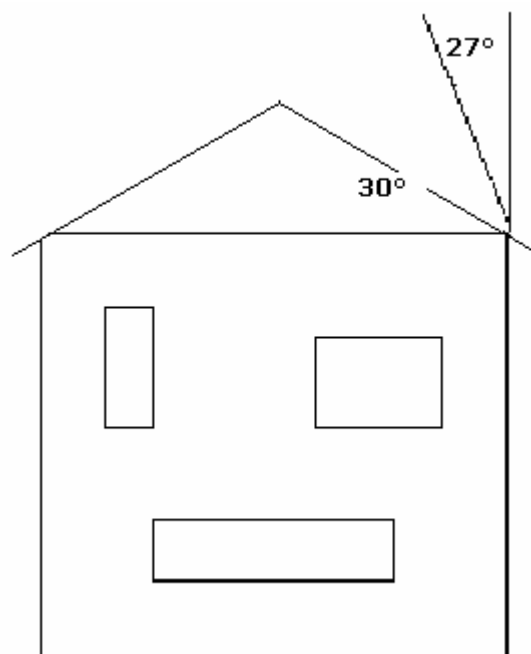
2. Calculate the ratio of the revolutions per minute for the fan pulley to rpms for the motor pulley as shown in the diagram. _____



3. A compressor is run by a motor. In the compressor runs at 500 rpms, at how many rpms does the motor run? _____



4. A solar heating panel needs to be oriented at 27° down from the vertical for maximum winter performance. The roof of the house has an angle of 30° with the horizontal. What angle will the brackets have that attach the back of the collection panel to the roof?
- _____



1. Identify each shape.

a) _____

b) _____

c) _____

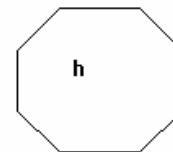
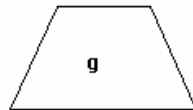
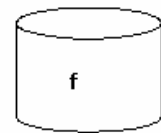
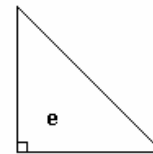
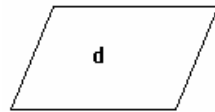
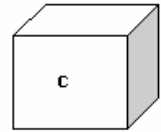
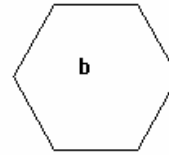
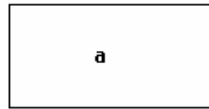
d) _____

e) _____

f) _____

g) _____

h) _____



2. Name the labelled parts on the flange (circle).

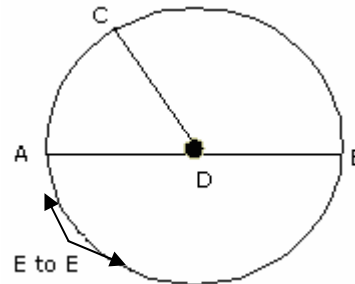
a) AB

b) AD, CD, BD

c) AC

d) E to E

e) ADC



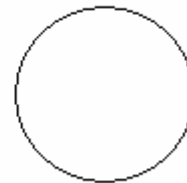
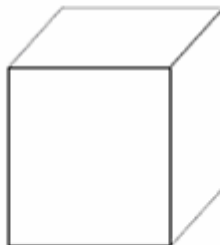
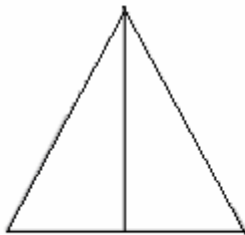
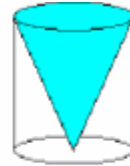
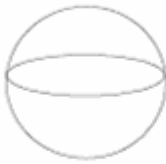
The number of degrees in a circle is _____

The number of degrees in a straight line is _____

The number of degrees in a right angle is _____

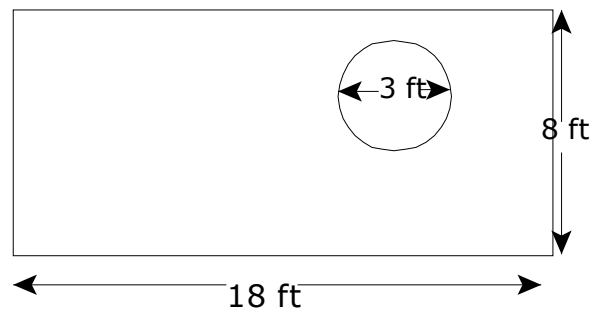
The number of degrees in any triangle is _____

3. Using the diagrams as a guide, match the formula to the appropriate description by putting the correct letter on the lines.



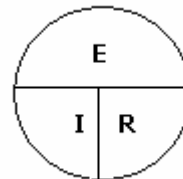
- | | | | | |
|----|---------------------------|-------|----|---------------------------|
| 1. | $p = 2l + 2w$ | _____ | a. | area of a triangle |
| 2. | $V = s^3$ | _____ | b. | circumference of a circle |
| 3. | $A = \pi r^2$ | _____ | c. | area of a circle |
| 4. | $V = \pi r^2 h$ | _____ | d. | volume of a cube |
| 5. | $A = \frac{1}{2} bh$ | _____ | e. | area of a rectangle |
| 6. | $V = \frac{4}{3} \pi r^3$ | _____ | f. | volume of a sphere |
| 7. | $C = \pi d$ | _____ | g. | volume of a cylinder |
| 8. | $A = lw$ | _____ | h. | perimeter of a rectangle |

4. You need to determine how much insulation will be needed for the wall illustrated here. The wall has a round window in it which is not insulated. Explain how you would do the calculations.



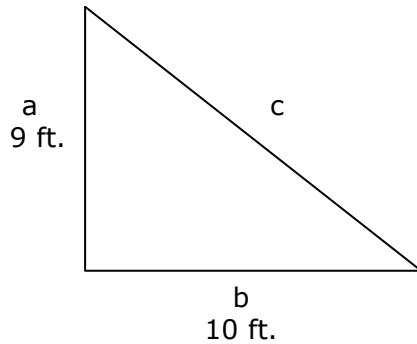
Ohm's Law is written as

$$I \text{ (current)} = \frac{E \text{ (voltage)}}{R \text{ (resistance)}} \quad \text{OR}$$

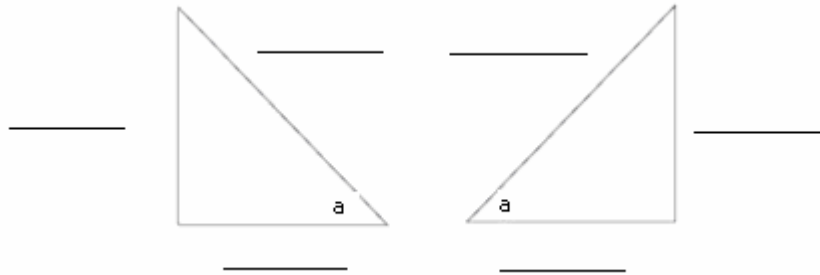


5. What would be the formula for E? _____
6. What would be the formula for R? _____

7. What is the length of side 'c' in this triangle? (use the formula $a^2 + b^2 = c^2$)



8. Angle 'a' is the reference angle in the triangles below. Identify the opposite, adjacent and hypotenuse sides for each of the triangles.



NAME: _____

DATE: _____

** To be completed by the Assessor – not the Learner***Speaking Skills Rating Scale**

		Improvement Needed	Acceptable	Very good
1.	Is comfortable communicating orally (i.e., body posture and facial expressions are appropriate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintains eye contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Waits for his/her turn to speak	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Willingly and confidently engages in conversation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Performs social courtesies, such as greeting others, using titles and making introductions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Speaks at an appropriate volume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Rate of speech is understandable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Adjusts voice inflection for statements, requests, directions, exclamations and questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Pronounces words clearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Does not use stalling devices such as "uh", "you know", etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Does not say the same thing twice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Uses words and phrases related to the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Has a good vocabulary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Speaks in complete sentences of appropriate length	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Uses good grammar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Maintains focus on the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Gives appropriate responses to questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Is aware of listener's reaction and responds appropriately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Talks "with" rather than "at" a person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In your work as a Refrigeration and Air Conditioning Mechanic, you need to speak with and listen to many people, including fellow technicians, apprentices, supervisors, employers and customers.

Rate your own ability/comfort level in the following work situations:

		Need help	Can do alone	Can help an apprentice
1.	Call suppliers to order parts, or obtain other information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Speak with customers to discuss the operation of equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Communicate with other trades to ensure that work can meet scheduling and code requirements and to promote a safe workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<http://srv108.services.gc.ca>, Essential Skill Profile Refrigeration and Air Conditioning Mechanic

NAME:

DATE:

		YES	NO
1.	Do you use a computer at home?	<input type="checkbox"/>	<input type="checkbox"/>
	at work?	<input type="checkbox"/>	<input type="checkbox"/>
2.	Do you use any computerized equipment/ systems at work, for example, sensor equipment or hand-held computers for real- time billing?	<input type="checkbox"/>	<input type="checkbox"/>
3.	Do you know the "language" used to describe computers, for example, monitor, CPU, hardware, software, data base, virus and spam?	<input type="checkbox"/>	<input type="checkbox"/>
4.	Rate your ability to do the following tasks:	Need help	Can do alone
	Find information on the Internet	<input type="checkbox"/>	<input type="checkbox"/>
	Send and receive email, including attachments	<input type="checkbox"/>	<input type="checkbox"/>
	Use a database	<input type="checkbox"/>	<input type="checkbox"/>
	Use word processing to write memos or reports	<input type="checkbox"/>	<input type="checkbox"/>
	Use spreadsheets to track information	<input type="checkbox"/>	<input type="checkbox"/>
	Display and send digital pictures of products and/or procedures used at work	<input type="checkbox"/>	<input type="checkbox"/>

NAME:

DATE:

In your work you will be required to keep a written record of certain job tasks. Please rate your ability to perform the following writing tasks.

		Need help	Can do alone	Can help an apprentice
1.	Complete work order forms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintain a logbook to record information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Complete start-up sheets for new installations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Prepare technical service reports.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Prepare a resumé.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Please write 5-6 sentences about yourself.

<http://srv108.services.gc.ca>, Essential Skill Profile Refrigeration and Air Conditioning Mechanic

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ASSESSOR'S ANSWER KEY**REFRIGERATION AND AIR CONDITIONING MECHANIC****Learning Styles**

After the apprentice has completed the learning styles checklist, note the sections that contain **three or more** checkmarks. Those sections indicate the preferred learning style of that apprentice. The majority of apprentices will show preference for more than one learning style.

Learning Environment

Group and individual learning environments: If an apprentice indicates a strong preference for one environment over another, an instructor needs to be aware of the implications this has for a teaching environment.

NAME:

DATE:

LEARNING STYLES CHECKLIST**Learning by hearing (auditory)**

- ☐ I remember the things I hear better than the things I see.
- ☐ I learn better when someone explains to me how to do something better than when I follow a diagram.
- ☐ I find it easier to remember a telephone number I have heard than one I have read.
- ☐ I prefer to listen to the news on the radio than to read the newspaper.
- ☐ I remember the times tables by saying them to myself.
- ☐ After I am introduced to someone, I'm good at remembering his/her name.

Learning by seeing (visual)

- ☐ I remember what I've seen, better than what I have heard.
- ☐ I remember what happened by seeing the incident in my head.
- ☐ I remember what I hear by picturing it in my head.
- ☐ I am good at remembering faces.
- ☐ When someone says a number, I don't understand it until I see it written down.
- ☐ I can add simple numbers which are written down better than numbers that are in my head (e.g., $16+24+10+98$).
- ☐ To remember a car license number, I picture it in my head.

Learning by doing (kinesthetic)

- ☐ When I put something together, I remember how it works.
- ☐ I remember certain directions after I have done something once or twice.
- ☐ I like to do things like simple repairs where I can use my hands.
- ☐ I can learn best if the instructor uses models, experiments and other practical tools to show what he/she is talking about.
- ☐ Using concrete examples is a good way for me to improve my math or spelling skills.
- ☐ I remember telephone numbers if I've dialed them a few times.

Learning in a group

- ☐ I like learning in a group so I can discuss the work with others.
- ☐ I enjoy helping other people in the group with their work.
- ☐ If I need to do something, I don't mind asking the person next to me.

Learning Alone

- ☐ I can concentrate best if I work on my own.
- ☐ It's hard to work if people are talking around me.
- ☐ I'd be embarrassed to show my mistakes to anyone other than an instructor.
- ☐ I can't concentrate if people are moving around the room.

(Adapted from SGL Handbook, ALSO, Ottawa)

ASSESSOR'S ANSWER KEY**REFRIGERATION AND AIR CONDITIONING MECHANIC****TECHNICAL LANGUAGE***1. Word Lists*

Have the apprentice begin reading aloud a list with which he/she is comfortable. If an apprentice has difficulty with more than three words in list one, **stop** the inventory. If the apprentice has 7/10 words correct in any list, move up to the next list. The lists have been written in a simple to more complex order and include words contextualized to each trade.

2. Pseudowords

The apprentice should not have major difficulty with the pronunciation of these pseudowords. The reason for inclusion of this list is that it tells the assessor if the apprentice has major difficulty with phonics, which can affect his/her ability to learn to read technical language at the required level.

3. Reading Excerpts

The reading passages are *not* leveled by Essential Skill complexity level but are arranged from simple to complex using a readability index. Apprentices should be able to answer both the recall questions as well as those questions requiring "reading between the lines." Apprentices need to be comfortable reading and answering questions at the highest level in the inventory.

1	2	3	4
duct	coupling	decimal	efficiency
height	amperes	rotary	refrigerant
code	circuit	radiant	capacitor
width	piston	conduit	insulation
grid	system	radius	specifications
gauge	corrode	ratio	utility
weigh	safety	components	evacuation
switch	vacuum	electronic	humidity
type	micron	appliance	thermometer
check	control	requirements	micrometer

poy

meef

fesh

moyp

toof

koyth

hafe

tibe

hoysh

thoop

marp

theg

yome

zule

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. How does refrigeration keep food from spoiling?

The cold temperature slows down the growth of the bacteria that cause food to spoil.

2. According to the article, how long does it take milk to spoil if left at room temperature?

Bacteria will spoil milk in 2-3 hours.

3. What does "non-bacterial ways" mean?

The milk deteriorates in other ways besides turning sour.

The Purpose of Refrigeration

The main reason for having a fridge is to keep food cold. Cold helps food stay fresh longer. The basic idea behind refrigeration is to slow down the growth of bacteria (which all food contains) so that it takes longer for the bacteria to spoil the food.

For example, bacteria will spoil milk in two or three hours if the milk is left out on a table or a counter. By reducing the temperature of the milk it will stay fresh for a week or two. The cold temperature inside the fridge slows down the growth of the bacteria that much. By freezing the milk, you can stop the bacteria altogether, and the milk can last for months (until effects like freezer burn begin to spoil the milk in non-bacterial ways).

Refrigeration and freezing are two of the most common forms of food preservation used today.

<http://chinesefoodsafety.com>
FOG Index 6.4

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. What does "cemf" mean?

It means counter electromotive force.

2. Describe how a magnetic relay is similar to a solenoid.

- Both are electromagnets
- Both have a weight or a spring to hold the contact points open
- High current flows in the running winding to magnetize the current relay which closes the contacts

Current (Magnetic) Relay

Current relays are usually found on low-torque, smaller horsepower motors. The current (magnetic) relay uses the electrical characteristics of the motor to operate.

As the motor picks up speed, magnetic fields build up and collapse in the motor. This produces a counter electromotive force (cemf) or voltage on the running winding. The running winding consumes more current when the motor is not running, or is turning slowly, than it does at full speed. Current-operated relay switches are used to close and open the starting winding. They operate on the change in current flow of the running winding. This is done as the winding goes from a start condition to run.

The magnetic relay is an electromagnet much like a solenoid. Either a weight or a spring holds the starting winding contact points open when the system is idle. When the motor control (thermostat or pressurestat) contacts close, high current flows in the running winding. The magnetic current relay coil is then heavily magnetized. It lifts the weight or overcomes the spring pressure and closes the contacts.

This action closes the starting winding circuit. The motor will quickly accelerate (speed up) to two-thirds or three-fourths of the rated speed. As it does so, the amperage draw of the running winding of the motor decreases. This decreases the magnetic strength of the magnetic current delay. The decrease is enough to allow the weight or the spring to open the points.

*Modern Refrigeration and Air Conditioning, 18th Edition, Althouse, Turnquist and Bracciano
FOG Index 8.5*

NAME: _____

DATE: _____

1. Why do HCFCs have a less harmful effect on global warming than CFCs?

The HCFCs have shorter lives and cause less ozone depletion.

2. What is the advantage of using HFCs over HCFCs as refrigerants?

HFCs have the potential to have a zero effect for ozone depletion and therefore a very slight effect on global warming.

3. a) Which type of refrigerant is R-134a?

It is an HFC.

- b) Why is R-134a not an easy replacement for R-12?

R-134a will not readily mix with either mineral oils or alkyl-benzene lubricants so existing oils must be replaced with synthetic oils.

HCFC Refrigerants

Hydrochlorofluorocarbons (HCFCs) are molecules composed of methane or ethane in combination with a halogen. This makes up a new molecule that is considered to be partially halogenated.

The HCFCs have shorter lives and cause less ozone depletion than the fully halogenated CFCs. Therefore, they have reduced potential for global warming. HCFCs such as R-22 and R-123 are considered to be interim refrigerants. They will be used until suitable replacements are available. The EPA requires the phaseout of HCFCs by the year 2030.

HFC Refrigerants

Hydrofluorocarbons (HFCs) include such refrigerants as R-134a and R-23. They are different from chlorofluorocarbons – they contain one or more hydrogen atoms and no chlorine atoms. HFCs are considered to have zero potential for ozone depletion. They have only a slight effect on global warming.

R-134a is typically used in new systems that are specifically designed for its use. The concept that R-134a is an easy replacement for R-12 is not correct, however. When using R-134a in retrofitting a system, numerous items must be considered. (Retrofitting is the updating of an existing system to new standards.) R-134a refrigerants will not readily mix with mineral oils or alkyl-benzene lubricants. Synthetic oils must be used for lubrication of hydrofluorocarbons; existing oils must be replaced.

The use of the proper recovery unit is necessary for the removal of R-12. There are also a number of other factors to be considered. These include system performance, hardware changes and existing material and lubricant compatibility. Prior to retrofitting a system, the technician should always check with the manufacturer to be certain that it is proper.

(FOG 9.5)

Modern Refrigeration and Air Conditioning, 18th Edition, Althouse, Turnquist and Bracciano

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. What "added value" can you, as an HVAC technician, be to a company?

You can display "professionalism" on the job by promoting the company in a positive manner, etc.

2. Why is it crucial to respect the customer's time?

It is crucial for building a level of trust with the customers.

3. For a company to be successful, does it always have to compete on price?

No. People are willing to pay more to deal with a reputable company that has a history of being fair.

4. What does "systematic troubleshooting" mean to you?

Answers will vary.

Productivity

In order for companies to survive in today's market, they must be able to produce quality service or product at a reasonable profit. For that, they need employees who take pride in their work and promote the company in a positive manner. In many cases, the technician will represent the face of the company, and your actions will be the basis of the customer's opinion of the company. If you show up when expected and present yourself as a well-organized professional, the customer will be more trusting and view your professionalism as an added value. If you cannot be on time, call ahead and inform the customer of the delay. This shows respect for the customer's time.

A company with a good reputation does not have to have the lowest prices. People are willing to pay a little extra for a reputable company with a history of fair dealings. In fact, lowering bid prices to obtain work or the promise of future work is probably the worst course of action. Satisfied customer will

tell a few of their friends and family members about the good service they received, but unhappy customers will tell everyone about a bad experience. As a valued employee, you must perform your work as quickly and professionally as possible. The best way to do this is to preplan your work and used systematic troubleshooting to identify the problem, think about the job and list the steps necessary to complete it. Then select the tools needed to get the job done correctly and as quickly as possible. Systematic troubleshooting and preplanning are steps to increasing your productivity.

(FOG Index 11.2)

HVACR 101 Air Conditioning Contractors of American, Plumbing – Heating – Cooling – Contractors – National Association Educational Foundation, Refrigeration Service Engineers Society, 2009

NAME:

DATE:

The effects of solar radiation are only evident on surfaces exposed to direct rays of sun. The table below indicates the added temperature difference.

1. According to the chart, what is the difference in the solar effect between a dark surface facing west and a light west-facing surface?

4°F

2. What is the difference in the effect between a light south-facing surface and a dark south-facing surface?

3°F

3. What is the difference in the effect between a dark flat roof and a light surface facing east?

16°F

Solar Effect (Temperature Difference Allowance)

Surface	East	South	West	Flat Roof
Dark	8° F	5° F	8° F	20° F
Medium	6° F	4° F	6° F	15° F
Light	4° F	2° F	4° F	9° F

NAME: _____

DATE: _____

The Interprovincial Red Seal exam for your trade consists of 125 multiple-choice questions. The exam topics and the percentage of questions are shown on the pie chart.

1. According to the chart, which two topics have the largest number of questions?

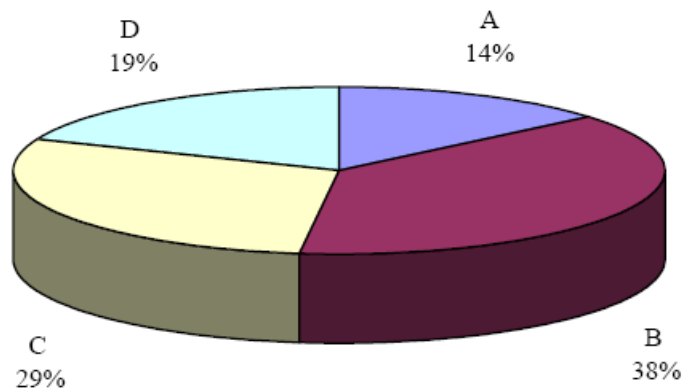
B – Refrigeration and Air Cooling Systems
C – Heating, Ventilating and Air Conditioning Systems

2. How many questions are on “Occupational Skills”?

18 questions

3. How many questions in total are on sections B and C?

84 questions



TITLE OF BLOCKS

Block A	Fundamental Occupational Skills	Block C	Heating, Ventilating and Air Conditioning Systems
Block B	Refrigeration and Air Cooling Systems	Block D	Control Systems

National Occupational Analysis 2004, Human Resources Partnership Directorate

NAME: _____

DATE: _____

1. According to the Fahrenheit and Celsius temperature scales, at what temperature Celsius does water turn to steam?

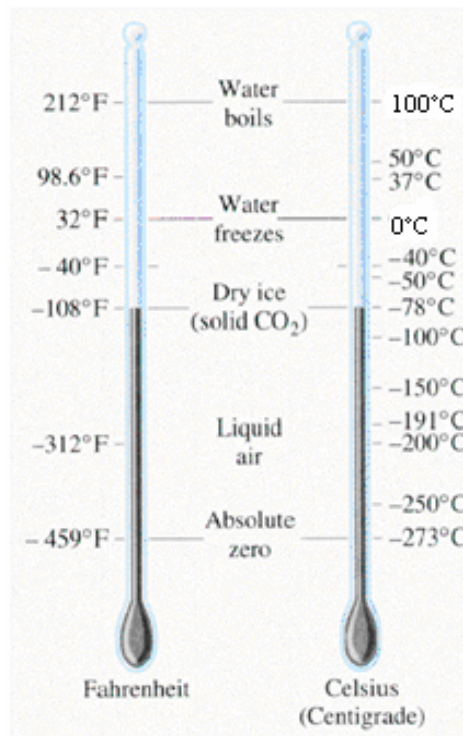
100°C

2. At what temperature Celsius does water freeze?

0°C

3. At which temperature are the two scales the same?

-40°



NAME:

DATE:

1. According to the table of contents from the 2005 National Building Code, which section of the NBC code applies particularly to your trade?

Part 6

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Canadian Commission on Building and Fire Codes and Standing Committees

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National Building Code of Canada, 2005, Volume 1

According to this excerpt from the National Building Code, would the following meet the required standards? If not, why not?

2. A pipe carrying water of 105° C has 10 mm clearance from the wooden floor joists.

No. The minimum clearance is 15 mm.

3. A pipe carrying water of 140° C is 30 mm from a wall.

Yes. The minimum clearance is 25 mm.

Section 6.2.9.3 Clearances

- 1) Clearances between combustible material and bare pipes carrying steam or hot water shall conform to table 6.2.9.3.

Table 6.2.9.3
Clearance Between Steam or Hot Water Pipes and Combustible Material
Forming part of Articles 6.2.7.1 and 6.2.9.3 and sentence 6.2.8.1 (2)

Steam or Water Temperature, °C	Minimum Clearance, mm
Up to 95	No clearance
Above 95 to 120	15
Above 120	25

(National Building Code of Canada, 2005, Volume 1)

SECTION	CONCEPT	QUESTION NUMBERS
1	Whole numbers	1-4, 20, 21, 22
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	Fractions	9-18, 19, 23a
	Conversions (fractions, decimals, percents)	20, 23b
2	Order of operations	1-2
	Exponents, square root, scientific notation	3-8
	Positive and negative numbers	9-10
	Metric and Imperial measures	11-22
	Percents	22-25
3	Ratio and proportion	1-3
	Geometry (angles)	4
4	Geometric figures	1
	Geometry (circles and angles)	2
	Formulae	3-6
	Geometry (Pythagorean Theorem 6-8-10 method)	7
	Trigonometry (angles)	8

NAME:

DATE:

Calculate the following:

$$1. \quad \begin{array}{r} 13812 \text{ mm} \\ + 16442 \\ \hline 30254 \text{ mm} \end{array} \quad 2. \quad \begin{array}{r} 3401 \text{ in.} \\ - 1824 \\ \hline 1577 \text{ in.} \end{array} \quad 3. \quad \begin{array}{r} 65 \text{ ft.} \\ \times 98 \\ \hline 6370 \text{ ft.} \end{array} \quad 4. \quad \begin{array}{r} 10\,024 \text{ km} \\ \div 24 \\ \hline 417.6 \text{ km} \end{array}$$

$$5. \quad \begin{array}{r} .0067 \text{ mm} \\ + .2543 \\ \hline 0.2610 \text{ mm} \end{array} \quad 6. \quad \begin{array}{r} 26 \text{ g} \\ - .03 \\ \hline 25.97 \text{ g} \end{array} \quad 7. \quad \begin{array}{r} .034 \text{ m} \\ \times .025 \\ \hline .00085 \text{ m} \end{array} \quad 8. \quad \begin{array}{r} 13.25 \text{ mm} \\ \div 25 \\ \hline 0.53 \text{ mm} \end{array}$$

$$9. \quad 6\frac{2}{5} + 1\frac{1}{5} = \quad \underline{6\frac{3}{5}} \quad 10. \quad \frac{2}{3} + \frac{1}{2} = \quad \underline{1\frac{1}{6}} \quad 11. \quad \frac{7}{9} - \frac{5}{9} = \quad \underline{\frac{2}{9}} \quad 12. \quad \frac{9}{5} \times \frac{7}{8} = \quad \underline{1\frac{23}{40}}$$

$$13. \quad \frac{2}{5} \div \frac{4}{6} = \quad \underline{\frac{3}{5}} \quad 14. \quad 1\frac{1}{5} \div 2\frac{1}{2} = \quad \underline{\frac{12}{25}}$$

Please give the mixed number equivalent or the improper fraction.

$$15. \quad \frac{10 \text{ mm}}{3} = \quad \underline{3\frac{1}{3} \text{ mm}} \quad 16. \quad 5\frac{7}{8} \text{ in.} = \quad \underline{4\frac{7}{8} \text{ in.}}$$

Write an equivalent fraction.

$$17. \quad \frac{3}{8} \text{ ft.} = \quad \underline{\frac{6}{16} \text{ ft.}} \quad 18. \quad \frac{2}{3} \text{ ft.} = \quad \underline{\frac{4}{6} \text{ ft.}} \quad (\text{Answers will vary})$$

19. What is the total weight of these air conditioning units: 40½ lb., 52 lbs., 30 ¾ lbs.?

$$\underline{123\frac{1}{4} \text{ lbs.}}$$

20. Complete the table below with the missing measurements:

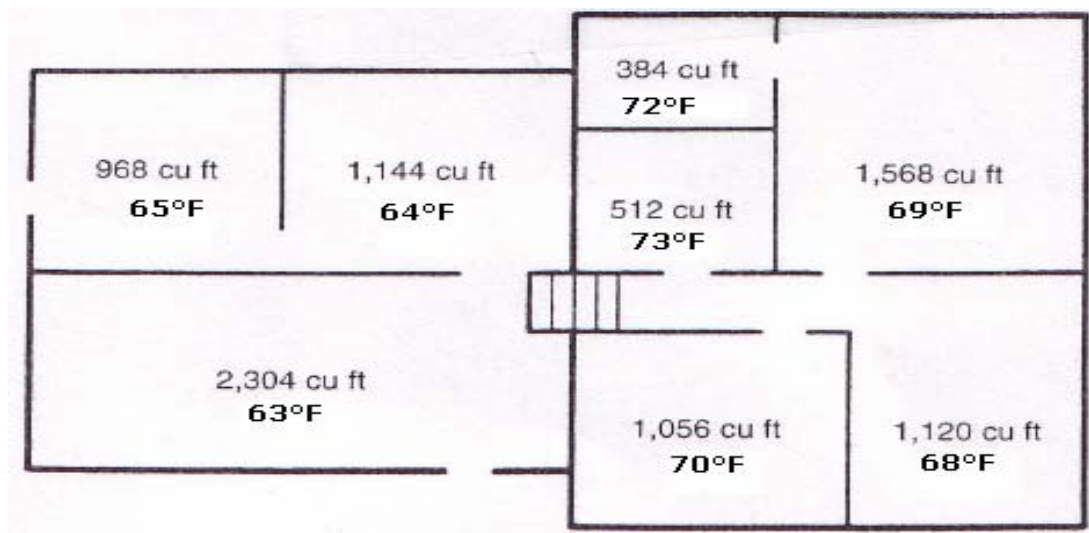
Fractional Inch	Decimal Inch	Percent
$\frac{1}{64}$	0.015625	1.56%
$\frac{3}{16}$	0.1875	18.75%
$\frac{1}{8}$	0.125	12½ % or 12.5%
$\frac{1}{16}$	0.0625	6¼ % or 6.25%
$\frac{1}{2}$.50	50%

21. At high speed, a blower delivers 2580 ft³/min. This volume is divided equally among 12 ducts. You need to know the amount of air in cubic feet that flows through each duct every minute. How would you calculate this?

Divide 2580 ft.³ / min. by 12

22. a) What is the total volume in ft³ of this house? 9056 ft.³

b) What is the average room temperature? 68°F



23. a) You are working with a circular duct that is $7 \frac{1}{2}$ inches in diameter. You then wrap the duct with insulation that is $1 \frac{1}{8}$ inches thick. What is the diameter of the duct now?

$9\frac{3}{4}"$

- b) Change your answer to a decimal fraction. $9.75"$

NAME: _____

DATE: _____

Calculate the following:

1. $72 \div 6 + 4 \times 3^\circ\text{F} = \underline{24}^\circ\text{F}$ 2. $6(25-5) + 16 - 2(8-6)^\circ\text{C} = \underline{132}^\circ\text{C}$

3. $6^3 = \underline{216}$ 4. $(2/3)^3 = \underline{8/27}$

5. $10^6 = \underline{1,000,000}$ 6. $10^{-3} = \underline{.001}$

7. $12^2 = \underline{144}$ 8. $(\sqrt{16})^3 = \underline{64}$

9. In January, the temperature at your work site fell from $+3^\circ$ to -15° C during the day. How many degrees did the temperature drop?

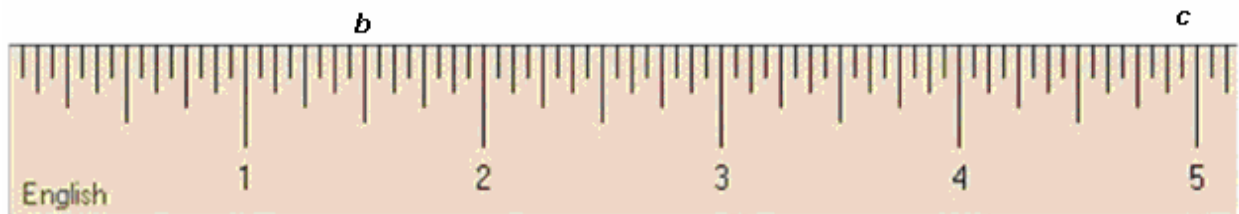
18°C

10. If the water temperature of a boiler changed from 211° F to 104° F, how many degrees of heat were lost?

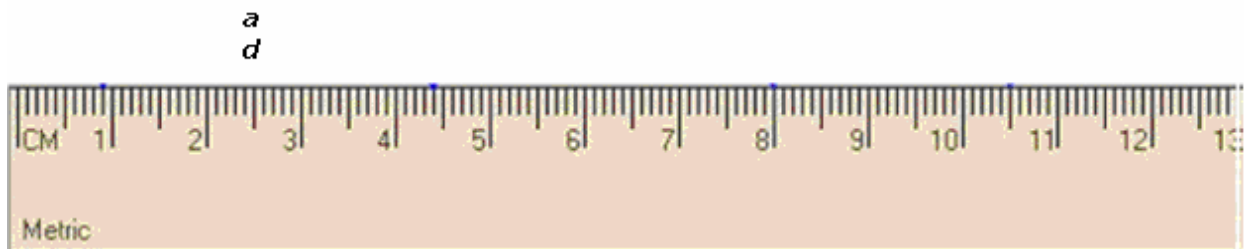
107°F

11. On the steel rules below, mark 25.4 mm, 1 $\frac{1}{2}$ in., 4 $\frac{15}{16}$ in. and 2.54 cm.

Imperial



Metric



Convert the following measurements of length:

1 inch = 2.54 cm 1 ft = 30.48 cm	3 ft = 1 yd 1 ft = 0.3048 m	° C = (°F - 32) x 5/9 ° F = (°C x 9/5) + 32
---	--	--

12. 1.046 mm = .1046 cm

13. 0.0086 mm = .000086 m

14. 144 in. = 4 yds.

15. 0.92 km = 920 m

16. 96 in. = 8 ft.

17. 3.4 ft. = 41 in.

18. ½ in. = 12.7 mm

19. 7 ft. = 213.36 m

20. 20°F = -6.6 °C

21. 31°C = 87.8 °F

22. During a forty hour work week, you spend 15 % of your time driving to and from various jobs. How many hours are you driving?

6 hours

23. Your company borrows money to buy new trucks. The interest paid on your loan is \$1440.00 which is actually 6% of the loan. How much money did you borrow?

\$24,000.00

24. The air in a room is completely replaced 4 times in an hour. What percent of the air is replaced in 5 minutes? (round your answer to the nearest whole percent).

33%

25. You are installing an air conditioning system in a building under construction. The bill for the installation is the cost of the parts plus overhead plus sales tax. The overhead is 75% of the cost of the parts. The parts cost \$3500.00. The sales tax is 4% of the cost of the parts plus overhead.

a) How much is the overhead? \$2,625.00

b) Calculate the sales tax. 245.00

c) What is the total amount of the bill? \$6,370.00

NAME: _____

DATE: _____

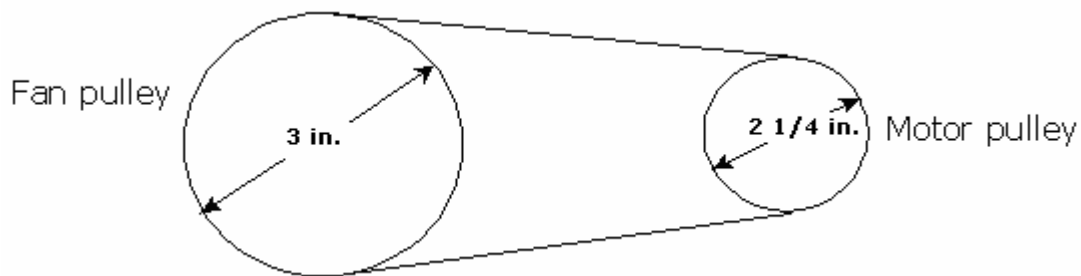
1. You are working with a refrigerant R-410 A which is a mixture of refrigerants R-32 and R-125. It takes 60 pounds of R-32 and 40 pounds of R-125 to make 100 pounds of R-410A. What is the ratio of R-32 to R-125?

3:2

When two pulleys with different diameters are connected by a belt, the rpms for each pulley are different. The ratio of the rpms is the inverse of the ratio of the pulley diameters.

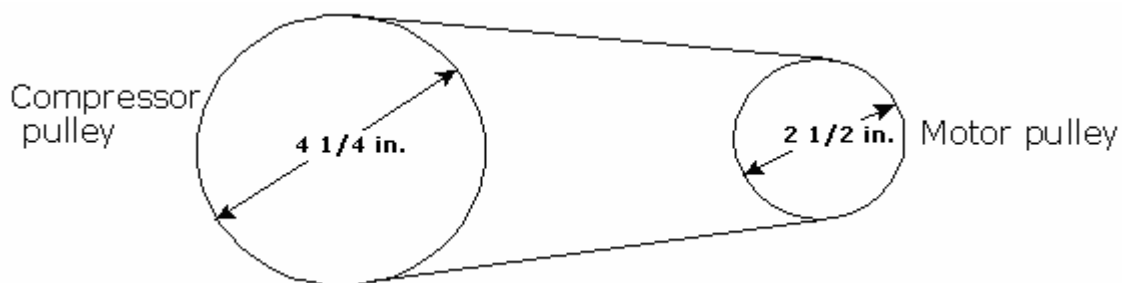
2. Calculate the ratio of the revolutions per minute for the fan pulley to rpms for the motor pulley as shown in the diagram. 4:3

(change fractions to whole numbers first) $2\frac{1}{4}:3$
 $9:12$
 $3:4$

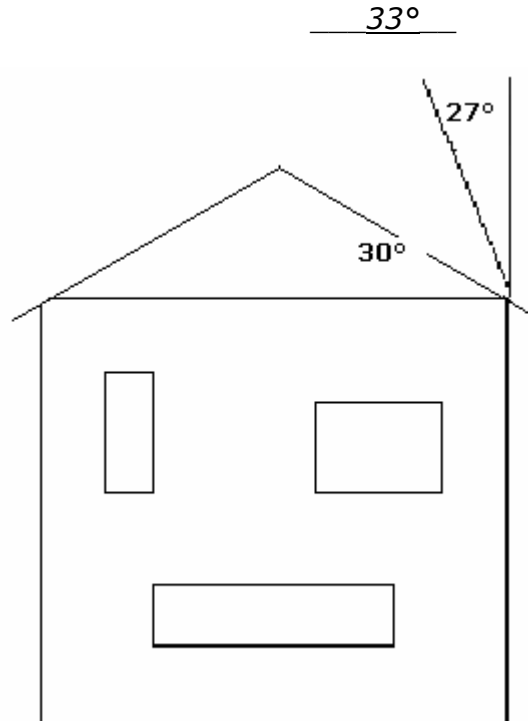


3. A compressor is run by a motor. In the compressor runs at 500 rpms, at how many rpms does the motor run?

$$\frac{2\frac{1}{2}}{4\frac{1}{4}} = \frac{500}{x} \quad x = 850 \text{ rpms} \quad \underline{850 \text{ rpms}}$$

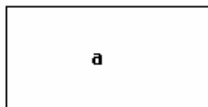


4. A solar heating panel needs to be oriented at 27° down from the vertical for maximum winter performance. The roof of the house has an angle of 30° with the horizontal. What angle will the brackets have that attach the back of the collection panel to the roof?

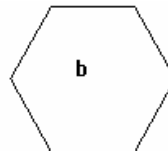


1. Identify each shape.

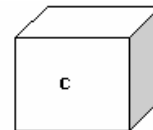
a) rectangle



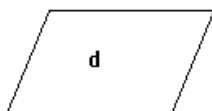
b) hexagon



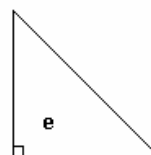
c) cube



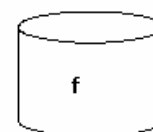
d) parallelogram



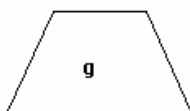
e) right triangle



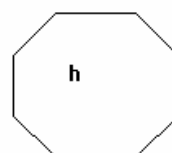
f) cylinder



g) trapezoid



h) octagon



2. Name the labelled parts on the flange (circle).

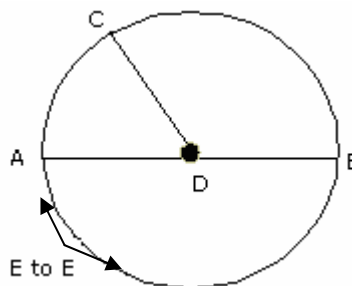
a) AB
diameter

b) AD, CD, BD
radius

c) AC
arc

d) E to E
circumference

e) ADC
section



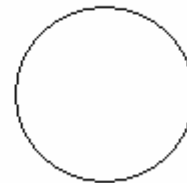
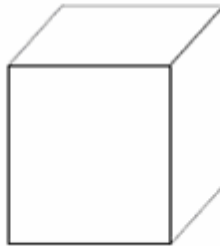
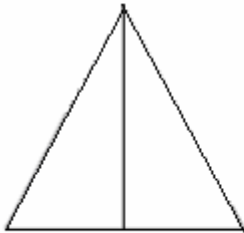
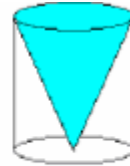
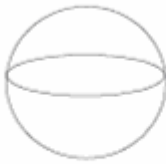
The number of degrees in a circle is 360°

The number of degrees in a straight line is 180°

The number of degrees in a right angle is 90°

The number of degrees in any triangle is 180°

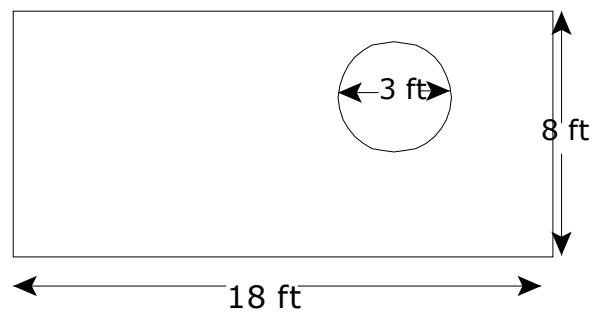
3. Using the diagrams as a guide, match the formula to the appropriate description by putting the correct letter on the lines.



- | | | | | |
|----|---------------------------|----------|----|---------------------------|
| 1. | $p = 2l + 2w$ | <u>h</u> | a. | area of a triangle |
| 2. | $V = s^3$ | <u>d</u> | b. | circumference of a circle |
| 3. | $A = \pi r^2$ | <u>c</u> | c. | area of a circle |
| 4. | $V = \pi r^2 h$ | <u>g</u> | d. | volume of a cube |
| 5. | $A = \frac{1}{2}bh$ | <u>a</u> | e. | area of a rectangle |
| 6. | $V = \frac{4}{3} \pi r^3$ | <u>f</u> | f. | volume of a sphere |
| 7. | $C = \pi d$ | <u>b</u> | g. | volume of a cylinder |
| 8. | $A = lw$ | <u>e</u> | h. | perimeter of a rectangle |
| 7. | $C = \pi d$ | _____ | g. | volume of a cylinder |
| 8. | $A = lw$ | _____ | h. | perimeter of a rectangle |

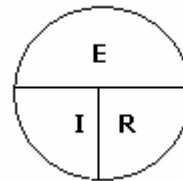
4. You need to determine how much insulation will be needed for the wall illustrated here. The wall has a round window in it which is not insulated. Explain how you would do the calculations.

1. Calculate the area of the wall – $A = lw$
2. Calculate the area of the window – $A = \pi r^2$
3. Subtract the area of the window from the area of the wall



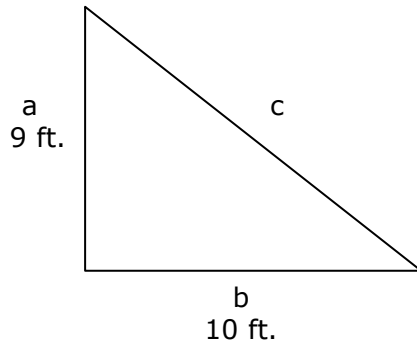
Ohm's Law is written as

$$I \text{ (current)} = \frac{E \text{ (voltage)}}{R \text{ (resistance)}} \quad \text{OR}$$



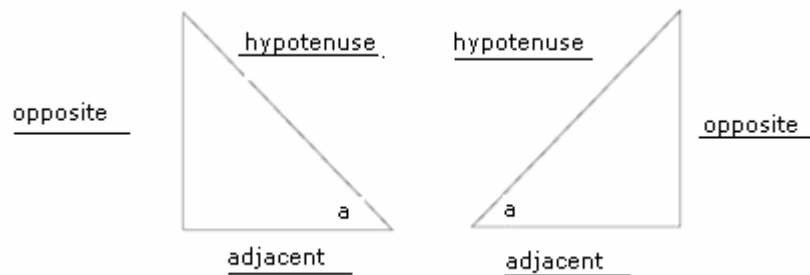
5. What would be the formula for E? $E = IR$
6. What would be the formula for R? $R = E/I$

7. What is the length of side 'c' in this triangle? (use the formula $a^2 + b^2 = c^2$)



$$\begin{aligned}(9)^2 + (10)^2 &= c^2 \\ 81 + 100 &= c^2 \\ C &= \sqrt{181} \\ \underline{C = 13.45 \text{ ft.}}\end{aligned}$$

8. Angle 'a' is the reference angle in the triangles below. Identify the opposite, adjacent and hypotenuse sides for each of the triangles.



ASSESSOR'S ANSWER KEY**REFRIGERATION AND AIR CONDITIONING MECHANIC****Oral Communication****Speaking scale**

This scale is to be completed by you, the assessor, during the course of the Essential Skills Inventory. While you may not have the opportunity to assess all the skills, you will be able to rate most of them. This scale may also be particularly helpful with those for whom English is not their first language, and it may be used for different cultural norms.

Examples of oral communication tasks

These are examples taken directly from the Essential Skill Profiles and range in complexity from simple to complex. The self-rating scale mirrors the stages of learning or skill-building.

NAME: _____

DATE: _____

** To be completed by the Assessor – not the Learner***Speaking Skills Rating Scale**

		Improvement Needed	Acceptable	Very good
1.	Is comfortable communicating orally (i.e., body posture and facial expressions are appropriate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintains eye contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Waits for his/her turn to speak	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Willingly and confidently engages in conversation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Performs social courtesies, such as greeting others, using titles and making introductions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Speaks at an appropriate volume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Rate of speech is understandable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Adjusts voice inflection for statements, requests, directions, exclamations and questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Pronounces words clearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Does not use stalling devices such as "uh", "you know", etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Does not say the same thing twice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Uses words and phrases related to the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Has a good vocabulary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Speaks in complete sentences of appropriate length	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Uses good grammar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Maintains focus on the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Gives appropriate responses to questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Is aware of listener's reaction and responds appropriately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Talks "with" rather than "at" a person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In your work as a Refrigeration and Air Conditioning Mechanic, you need to speak with and listen to many people, including fellow technicians, apprentices, supervisors, employers and customers.

Rate your own ability/comfort level in the following work situations:

		Need help	Can do alone	Can help an apprentice
1.	Call suppliers to order parts, or obtain other information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Speak with customers to discuss the operation of equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Communicate with other trades to ensure that work can meet scheduling and code requirements and to promote a safe workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<http://srv108.services.qc.ca>, Essential Skill Profile Refrigeration and Air Conditioning Mechanic

ASSESSOR'S ANSWER KEY

REFRIGERATION AND AIR CONDITIONING MECHANIC

Computer use

The computer use scale is not reflective of the computer use referenced in the Essential Skills Profile. However, there are basic computer skills required for survival in today's economy.

The scale used in this inventory reflects those very basic skills.

NAME:

DATE:

		YES	NO
1.	Do you use a computer at home?	<input type="checkbox"/>	<input type="checkbox"/>
	at work?	<input type="checkbox"/>	<input type="checkbox"/>
2.	Do you use any computerized equipment/ systems at work, for example, sensor equipment or hand-held computers for real- time billing?	<input type="checkbox"/>	<input type="checkbox"/>
3.	Do you know the "language" used to describe computers, for example, monitor, CPU, hardware, software, data base, virus and spam?	<input type="checkbox"/>	<input type="checkbox"/>
4.	Rate your ability to do the following tasks:	Need help	Can do alone
	Find information on the Internet	<input type="checkbox"/>	<input type="checkbox"/>
	Send and receive email, including attachments	<input type="checkbox"/>	<input type="checkbox"/>
	Use a database	<input type="checkbox"/>	<input type="checkbox"/>
	Use word processing to write memos or reports	<input type="checkbox"/>	<input type="checkbox"/>
	Use spreadsheets to track information	<input type="checkbox"/>	<input type="checkbox"/>
	Display and send digital pictures of products and/or procedures used at work	<input type="checkbox"/>	<input type="checkbox"/>

ASSESSOR'S ANSWER KEY**REFRIGERATION AND AIR CONDITIONING MECHANIC****Writing**

The first questions in the writing section are examples taken directly from the Essential Skills Profile for the trade and range in difficulty from simple to more complex. The scale used for self assessment of these skills reflects the stages of learning: "need help, can do alone and can help an apprentice."

The second part requires the apprentice to provide a brief personal writing sample by composing 5-6 sentences.
Criteria for evaluating the sample are:

- Does the apprentice use print or cursive writing?
- Is the writing legible?
- Can the apprentice do the activity easily or does he/she struggle to write a sentence or two?
- Can the apprentice put his/her thoughts on paper in a logical order?
- Can the apprentice use punctuation correctly?
- Can the apprentice spell correctly?
- Can the apprentice use correct grammar?

NAME:

DATE:

In your work you will be required to keep a written record of certain job tasks. Please rate your ability to perform the following writing tasks.

		Need help	Can do alone	Can help an apprentice
1.	Complete work order forms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintain a logbook to record information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Complete start-up sheets for new installations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Prepare technical service reports.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Prepare a resumé.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Please write 5-6 sentences about yourself.

<http://srv108.services.gc.ca>, Essential Skill Profile Refrigeration and Air Conditioning Mechanic

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Appendix A - Lesson Plan Template

Appendix B – Essentials Skills for All Apprentices

1. Introduction

The Curriculum Guidebook is designed to provide support and practical advice to instructors who are delivering Essential Skills training, as well as to those who wish to incorporate Essential Skills into technical training. Currently, this Guidebook has been prepared for thirteen trades; however, the template can be adapted for use in any trade.

The thirteen trades include:

- Automotive Service Technician
- Cabinetmaker
- Carpenter
- Cook
- Construction Electrician
- Industrial Electrician
- Machinist
- Metal Fabricator
- Oil Burner Mechanic
- Plumber
- Refrigeration and Air Conditioning Mechanic
- Steamfitter-Pipefitter
- Welder

2. Why Essential Skills?

Essential Skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in every occupation and throughout daily life in different ways.

- Reading Text
- Document Use
- Numeracy
- Oral Communication
- Writing
- Computer Use
- Thinking Skills
- Working with Others
- Continuous Learning

*The Trade Essentials curriculum materials currently uses **six** of these Essential Skills: **Reading, Document Use, Numeracy, Oral Communication, Writing and Computer Use***

For more information on Essential Skills, visit the website at www.hrsdc.gc.ca/essentialskills

Although the term 'Essential Skills' has been around for a number of years, there is growing recognition of the link between Essential Skills and success in the trades. Essential Skills are used in every occupation and more specifically, in every trade, but they are used in different ways and at varying degrees of difficulty.

These skills are not technical skills though they may be taught using materials or examples from a particular trade. Rather, they are the foundational skills that exist in all occupations. The six Essential skills outlined above were used in the creation of materials for the Trade Essentials project.

The Curriculum Frameworks identify the Essential Skills requirements for thirteen trades and provide concrete examples of how these skills are utilized in each trade.

The Essential Skill requirements are based primarily on HRSDC's Essential Skills profiles www.hrsdc.gc.ca/essentialskills and the National Occupational Analyses.

(<http://www.red-seal.ca/tr.1d.2n.4adeta.3l@-eng.jsp?tid=230>)

They have been reviewed and validated by certified tradespeople and supplemented by additional research gathered from the Trade Essentials project.

3. Instructor Requirements

To be effective, curriculum development and delivery must be guided by the principles of adult education. Learners in the Essential Skills programs will have a wide variety of backgrounds, work experience, education and work-related credentials. Many of these learners will be employed in full time positions with additional responsibilities outside of work. It is critical for the instructor to understand the unique requirements of adult learners and be prepared with challenging, relevant and engaging learning activities.

- Instructors must have knowledge and experience in the area of adult education.
- Instructors should have experience in working in a multi-level classroom environment.
- Instructors must be familiar with Essential Skills, how Essential Skills are used in the trades, and with the trade itself. Red Seal certification is encouraged.
- Instructors must be able to provide the link between Essential Skills and the trade and will provide a trade context from their own experience and expertise. In some instances a team approach with both an Essential Skills and a trades instructor may be preferable.
- It is important that those who presently provide technical training also receive training to increase their understanding of Essential Skills.

4. Curriculum Development

The curriculum frameworks are derived from an outcomes-based approach to learning focusing on the *outcome* of the intervention or course of study-what the learner will be able to do or will know at the end of the intervention. They have been developed to

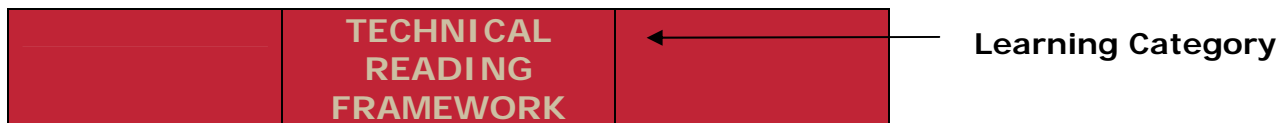
support individual learning needs in each of the six Essential Skills and are the generic **Essential Skills Maps** for all thirteen trades included in the Trade Essentials project.

The following describes the structure and components of the curriculum frameworks developed for apprentices at the Trade Essentials Centre.

Learning Category

A Learning Category (as defined by Trade Essentials) is a general curriculum outcome and is one of the six Essential Skills identified for development in the Trade Essentials project: Reading Text, Document Use, Numeracy, Oral Communication, Computer Use and Writing. It appears in the top band across each of the six frameworks as shown in the example below.

Note: Reading Text will be referred to as Technical Reading in all frameworks



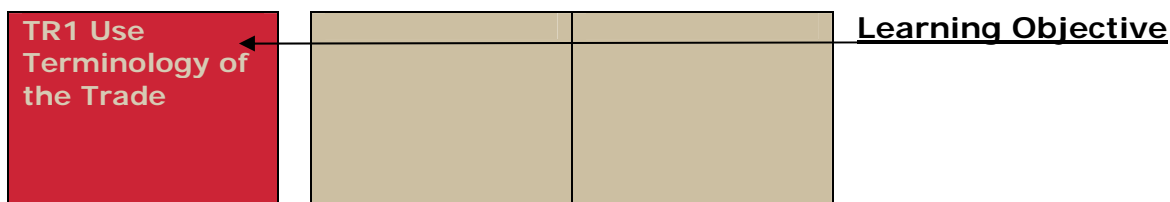
Learning Outcome

A Learning Outcome is a specific curriculum outcome and describes what a learner should know or be able to do as the result of a course of study. Trade Essentials has identified one Learning Outcome for each Learning Category. The learning outcome statement appears below the Learning Category. For example, the learning outcome in the Trade Essentials Technical Reading Framework is:

Learners will locate, recall, understand and interpret information in written text

Learning Objective

Learning objectives are the standards or benchmarks that identify what learners will know or will be able to do as the result of the completion of a number of related competencies in a particular "band". In the example below, the objective for the band is:
TR1 – Use Terminology of the Trade (Burgundy Box).



Competency

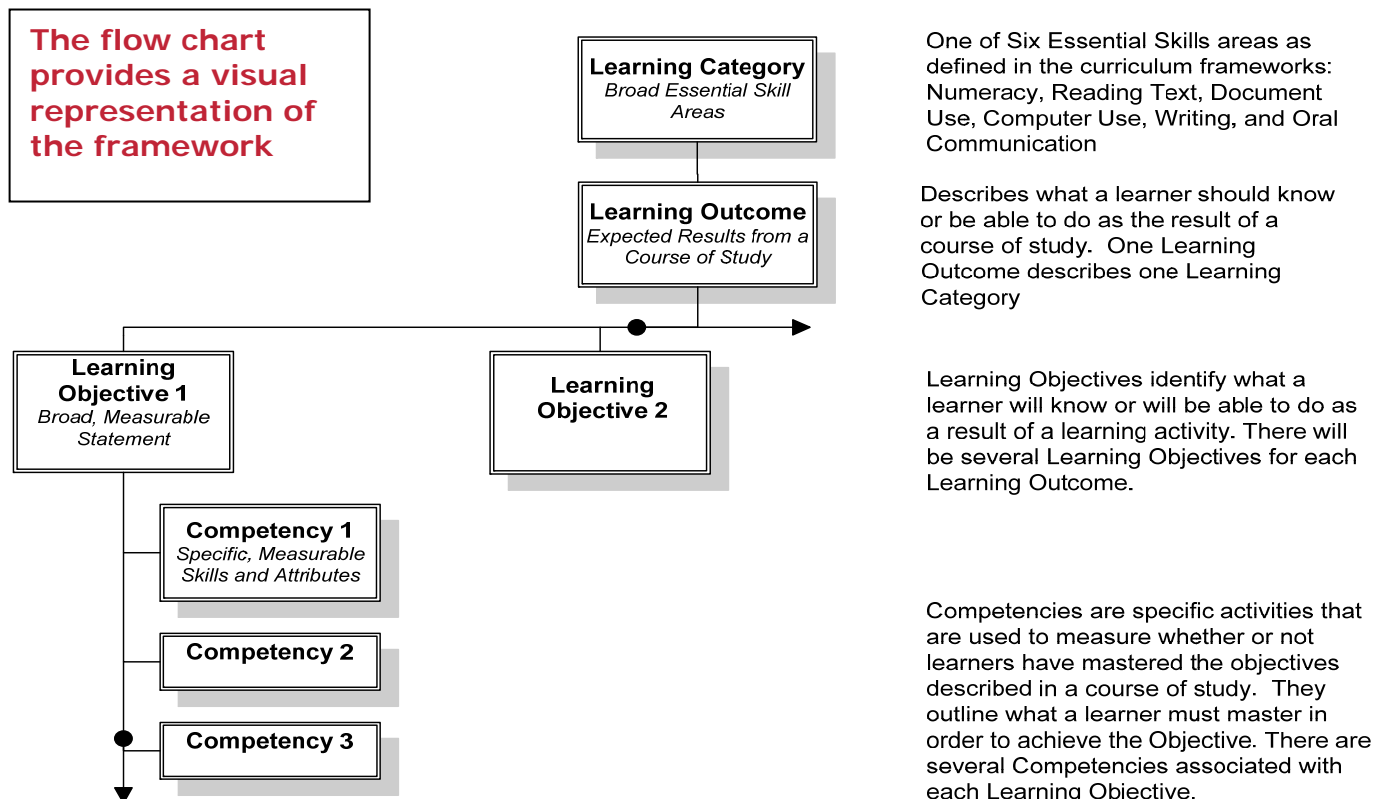
While an objective describes ‘what’ we expect learners to achieve, competencies identify ‘how’ learners can achieve that objective. Competencies are specific activities used to measure whether or not learners have mastered the objective. In Table 1 below, the learner must master competencies 2.1 and 2.2 (taupe boxes) to demonstrate mastery of the objective. Where objectives demonstrate the end result, competencies are a means to that end.

Competencies provide a framework for selecting instructional materials and techniques and provide a basis for determining when instruction has been successful.

Table 1

TR2 Use Strategies to Improve Understanding and Recall	2.1 Identify strategies to improve understanding and recall of written information	2.2 Implement strategies to improve understanding and recall of written information	<u>Competency</u>
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Curriculum Overview



5. Curriculum Resources

Three types of resources are identified in the curriculum guidelines: *non-contextualized*, *contextualized*, and *technical*. These resources have been listed throughout the guidelines. It is not intended that instructors use all of the resources outlined but, instead, choose material and deliver its content as it best suits individual learner needs.

Non-contextualized resources are not related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials. They can be useful when learners have identified literacy challenges or when basic strategies need to be understood before applying them to higher order learning.

Contextualized resources provide Essential Skills applications in the context of a specific trade or occupation and are generally written at a more basic level than technical materials. They are particularly useful when learners have identified Essential Skills gaps but can only identify relevance/motivation to the task if it is related to their specific trade.

Technical resources are trades training materials from which Essential Skills can be extracted. These resources are written at a higher reading level than non-contextualized and contextualized resources and can often be found in block release training and college trade programs. Generally, learners who would benefit from these materials have few Essential Skills gaps in their learning.

6. Preparation and Delivery

Instructors will be provided with a complete copy of the Essential Skills Frameworks associated with the trades/courses for which they are responsible. Instructors will use essential skills assessment information to build a learning session for one client or a group of clients.

The instructor will be required to prepare lesson plans as a tool to organize and plan the delivery of training. A lesson plan template is included in Appendix A. A brief description of each section of the lesson plan is included in the attached template to serve as a guide. The instructor may add additional notes and documents as required. Completed lesson plans should be kept on file to provide continuity in subsequent sessions.

It is important to note that, even though objectives and competencies progress from least to most difficult, instruction need not move in a linear fashion. In recognition of their prior knowledge, learners may begin their study at any objective in the curriculum frameworks, may not require instruction in all of the competencies in each band, and/or may simultaneously complete competencies in all six Essential Skill curriculum frameworks.

Learners who have extensive Essential Skills gaps may require that the curriculum framework be followed using a linear approach beginning with the least complex objectives.

The curriculum frameworks are applicable to all thirteen trades identified for the project. For instance, though *“Using Documents”* is identified as important to both cooks and carpenters; however, the way documents are used in the trade is what makes them relevant to that specific trade.

The exception is “Numeracy” where not all objectives listed are required in all thirteen trades. For example, a cook may not be required to master all of the learning objectives outlined in the framework whereas a machinist requires mastery of all. Appendix B includes a checklist of the skills required for each particular trade.

The guidelines define objectives and competencies and identify matching resources. The instructor can then use these resources to develop lesson plans that best suit the needs of their particular audience.

Though frameworks are written in academic language (at an academic level), the intent is that the objectives and competencies be taught using **trade specific examples**. Curriculum frameworks may be delivered one-on-one or in a group learning environment.

6.1 Approaches to Delivery

The delivery approach can be **stand alone** or **cross curricular**, depending on the needs of the client or client group.

A **stand alone approach** involves using any one of the curriculum frameworks in its entirety as a stand alone course. For example, carpenters who have been away from the classroom for a long time may benefit from a review of the complete Numeracy framework and focus solely on that Essential Skill.

Others, including those who have achieved journey person status, may require a Computer Course or a course in Oral Communication to improve their skills in dealing with customers or in mentoring new apprentices.

It is assumed that in many classroom situations instructors will use a **cross-curricular approach** to develop a number of skills at the same time.

All students will benefit from instruction in how to understand and retain information from trade-related materials. For example, using the codebook for locating information can address both technical reading and document use. An activity which requires the learner to complete an invoice may provide the opportunity to incorporate technical reading, writing, document use and numeracy in one exercise.

It is intended that Essential Skills can be embedded in the curriculum wherever possible and that instruction in many of the skill areas will not be time-tabled as such. It has

been proven that a learning environment that provides opportunity for discussion and interaction among learners will improve comprehension and long-term memory.

7. Measuring Learning: Instructor's Role in Evaluation

There are a number of informal methods that could be used periodically by the instructor to ensure progress. It is important to note that measurement is not based on a "Pass-Fail;" it is understood that the learner sees the value in improving their skill level and will continue to develop their skills until they are comfortable and confident in performing the required tasks.

Informal Evaluation Methods:

- Provide opportunities and simple recording forms for the learner to assess their progress.
- Review individual assessments on a regular basis against the curricula framework
- Pay particular attention to those identified as potential "early leavers" to ensure they are moving forward as anticipated.
- Pay attention to those who experience unanticipated difficulties in the group environment.
- Document observations of performance in class
- Develop a rubrics for a particular objective that can be shared with students

Formal Evaluation:

- Where a more formal evaluation approach is desired, the instructors or learners could design and complete a structured checklist (see sample checklist in Appendices). Mastery of skills at the highest level using the application to the trade would demonstrate that the learner meets trade requirements.

8. Intervention Timeframe

The Trade Essentials interventions have been developed for individualized learning; therefore, no set time period has been determined for the delivery of the material. Learners' prior knowledge and time necessary to learn or relearn skills should determine the length of time spent in the intervention. For that purpose, a continuous exit policy should be implemented into all programs. There may be a mixture of "early leavers" (those identified as having few or isolated essential skills gaps), with those who have broader range of needs.

Appendix A

Trade Essentials Lesson Plan Template

Course Title:		Dates:	
Instructor:		Location:	

Session Topic(s):		Duration:	
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Session Description:
Describe what you plan to accomplish during the session or group of sessions. Why is this learning important? What is the context for the learning?

Learning Outcomes, Objectives, and Competencies:
List or attach the specific or related Learning Outcomes, Objectives, and Competency statements (from the framework) here.

Assessment and Evaluation Strategies:
Outline or attach learner evaluation strategies that align with specific Learning Outcome, Objectives, and Competencies. Pre- or post-tests; in-class exercises; individual skill inventories; etc.

Teaching Points and Organization:

Time	Content and Delivery Method
	Use this section to prepare a schedule of learning activities and events. For example:
7:00-7:15	Use bridge-in activity (describe activity) to gain student interest and prepare them to learn
7:15-8:00	Using carpentry estimating handout, have students work on assignment in groups of 2 then debrief assignment
8:00-8:15	Break
8:15-8:20	Energizer activity (describe activity) to refocus students on learning

Resources and Materials Required:

List resources and materials you will use during this session. If applicable, attach copies, descriptions or links to items such as handouts, assignments, demonstration equipment, websites, readings, activities or other specific resources for instructor and/or student use.

Accommodations:

Describe any teaching/learning accommodations that may be implemented in this session to support learner diversity.

Reflective Notes:

How did the session go? What worked well and what work not so well? Outline any ideas for improvement that can be made for the next session.

Appendix B – Essential Skills for All Apprentices

	Automotive Service Tech	Carpenter	Cabinet Maker	Construction Electrician	Cook	Industrial Electrician	Machinist
PM1 Use Calculators	✓	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	Whole numbers only	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓	✓
PM7 Use Percent	✓	✓	✓	✓	✓	✓	✓
PM8 Use Conversion	✓	✓	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	✓	✓	✓	✓	✓	✓	✓
PM11 Use Square Root and Exponents	✓	✓	-	✓	-	✓	✓
PM12 Solve Equations	✓	✓	✓	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	-	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	-	✓	✓
PM18 Analyze Numerical Data	✓	-	-	-	✓	-	✓

CURRICULUM GUIDEBOOK

	Metal Fabricator	Plumber	Refrigeration & Air Conditioning Mechanic	Oil Burner Mechanic	Steamfitter/ Pipefitter	Welder
PM1 Use Calculators	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓
PM7 Use Percent	-	-	✓	✓	✓	✓
PM8 Use Conversion	-	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	-	No proportion	✓	✓	✓	No proportion
PM11 Use Square Root and Exponents	-	-	✓	✓	✓	✓
PM12 Solve Equations	-	Plus quadratic equations	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	✓	✓
PM18 Analyze Numerical Data	-	-	✓	✓	-	-

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CURRICULUM FOR

REFRIGERATION AND AIR CONDITIONING MECHANIC

NOC 7313

OIL BURNER MECHANIC

NOC 7331

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Technical Reading (TR) Learning Outcome: Learners will locate, recall, understand and interpret information in written text

TR1 Use Terminology of the Trade

1.1 Identify strategies to organize and remember new terminology

1.2 Implement strategies to organize and remember new terminology

TR2 Use Strategies to Improve Understanding and Recall

2.1 Identify strategies to improve understanding and recall of written information

2.2 Implement strategies to improve understanding and recall of written information

TR3 Read to Perform Job Tasks

3.1 Identify purpose of reading information to perform job tasks

3.2 Locate specific information

3.3 Skim for overall meaning

3.4 Read to understand and learn

3.5 Read to critique

3.6 Read to evaluate

TR4 Improve Examination Performance

4.1 Identify barriers to successful examination performance

4.2 Identify strategies to improve examination performance

4.3 Implement strategies to improve examination performance

*Learners will locate, recall, understand and interpret
information in written text*

Introduction

Readers of all abilities can benefit from practice in the use of comprehension strategies proven to be habits of effective readers. Success in technical training and in the trade requires that apprentices understand, connect with, and recall important information. Knowing the language of the trade and developing strategies to quickly locate specific information in reading materials such as code books, manuals and texts will not only increase reader comprehension but also productivity on the job.

Just as it is important to think about reading and study habits, it is important to think about strategies to be used during the exam writing. Whether writing tests that are required during technical training or getting ready to write the Red Seal Certification exam, adequate test preparation is essential. As multiple choice testing is the most common form of assessment for certification, knowing how multiple choice questions are constructed and applying strategies for responding can significantly improve test scores.

Technical Reading in the Heating and Cooling Trades

Refrigeration and air conditioning mechanics and oil burner mechanics use technical reading on a daily basis to complete job tasks. According to Human Resources and Skills Development Canada's Essential Skills Profile (<http://srv108.services.gc.ca/>), the reading tasks performed by refrigeration and air conditioning mechanics range from reading short texts to locate a single piece of information (i.e., read work orders to ensure the correct piece of equipment is being installed) to integrating and synthesizing information from multiple sources or from complex and lengthy text (i.e., read detailed diagnostic procedures in equipment manuals to determine the cause of unit malfunctions).

Though no Essential Skills profile exists for oil burner mechanics, information gleaned from the trade's National Occupational Analysis suggests that the complexity of the tasks performed by oil burner mechanics correlates with that of refrigeration and air conditioning mechanics.

Both read and apply safety regulations, company safety policies, and environmental guidelines and regulations. They read and are able to locate specific information in the electrical, plumbing, oil, building, and safety codes to ensure that the process they follow meets industry requirements and complies with other codes.

Refrigeration and air conditioning mechanics and oil burner mechanics read and interpret manufacturer's specifications, permits, warranties, and invoices and have a grounded knowledge of trade terminology present in reading documents. In many cases, the text used by these tradespeople is complex, lengthy and technical.

Introduction to the Curriculum Guide

Success in technical training and performance on the job requires that apprentices have strong Essential Skills. Although all Essential Skills contribute to success, this guide is intended to help apprentices in the heating and cooling trades develop the reading strategies necessary to locate, understand, interpret, and recall information presented in a variety of text formats common to the trades.

It is assumed that the instruction for the Technical Reading course will not be time-tabled as such, but instructors will use a cross-curricular approach to incorporate reading strategies using the materials of the trade.

The following guide outlines a list of recommended resources (See Appendix A) for each objective in the Technical Reading curriculum framework and, where possible, includes online website materials that complement these resources. Three formats are provided to allow learners the opportunity to review competencies in a way that best suit their needs. These resources are categorized as follows:

- **Non-contextualized** - Curriculum resources that are **not** related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials.
- **Contextualized** - Curriculum resources that provide Essential Skills applications in the context of a specific trade or occupation.
- **Technical** - Trade training materials from which Essential Skills are extracted.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose materials and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

The following websites contain both heating and cooling-related and generic content which may be used as an additional reading forum.

Heating and Cooling-Related Online Websites:

- <http://highperformancehvac.com/> (High Performance HVAC)
- www.plumbingandhvac.ca/ (Plumbing and HVAC Information)
- www2.worksafebc.com/Portals/Construction/Home.asp?_from=construction.healthandsafetycentre.org (Preventing injuries and illnesses in construction trades)
- www.advancedbuildings.org/ (Advanced Buildings)
- www.allhvacinfo.com/ (Directory of HVAC Information)
- www.hvacmechanic.com/ (General HVAC Information)
- www.hvacportal.com/ (HVAC-related Information on Various Topics)
- www.ciph.com/Your_Industry_Trade_Section/About_Us/ (Canadian Institute of Plumbing and Heating)
- www.mcac.ca/ (Mechanical Contractors Association of Canada)
- www.phccweb.org/ (Plumbing Heating Cooling Contractors Association)
- www.ashrae.org/ (American Society of Heating, Refrigeration, and Air Conditioning Engineers)
- www.coha.ca/ (Canadian Oil Heat Association)
- www.hrai.ca/ (The Heating, Refrigeration, and Air Conditioning Institute of Canada)
- www.alternative-heating.com/waste-oil-burner.html (Waste Oil Burner Basics)
- www.hvacmechanic.com/heating/sequence_of_operation_for_an_oil.htm (HVAC Mechanic.com)
- www.abma.com/ (American Boiler Manufacturers Association)
- www.coha.ca/ (Canadian Oil Heat Association)
- www.furnaceshq.com/ (Furnace Resource Directory)
- www.heatpumpcentre.org/ (Heat Pump Information)
- www.nationalboard.org/NationalBoard/Default.aspx (The National Board of Boiler and Pressure Vessel Inspectors)
- www.ccbda.org/ (Canadian Copper and Brass Development Association)
- www.cwwa.ca/home_e.asp (Canadian Water and Wastewater Association)
- www.mcac.ca/ (Mechanical Contractors Association of Canada)
- www.phccweb.org/ (Plumbing Heating Cooling Contractors Association)
- www.pmihome.org/ (Plumbing Manufacturers Institute)
- www.diydata.com/plumbing/index.php (Plumbing-related Information on Various Topics)

Generic Websites:

- www.red-seal.ca/Site/index_e.htm (The Interprovincial Standards Red Seal Program)
- www.ccohs.ca/ (Canadian Centre for Occupational Health and Safety)
- www.hrsdc.gc.ca/en/labour/workplace_health/index.shtml (Workplace Health and Safety)

- www.hrsdc.gc.ca/en/hip/hrp/essential_skills/essential_skills_index.shtml (Human Resources and Social Development Canada-Essential Skills Website)
- www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php (WHMIS)
- www.wcb.pe.ca/index.php3?number=60189 (Worker's Compensation Board of PEI)
- www.gov.pe.ca/educ/index.php3?number=74951 (PEI Apprenticeship Training)
- www.irc.nrc-cnrc.gc.ca/codes/home_E.shtml (Canadian Codes Centre)
- www.jobsafecanada.ca/en/default.html (Job Safety Information)
- www.canoshweb.org/ (Canada's National Occupational Health and Safety Website)
- www.oshweb.com/ (Index of Occupational Health and Safety Resources)
- www.iapa.on.ca/about_iapa/about_intro.asp (Industrial Accident Prevention Association)
- www.cos-mag.com/ (Canadian Occupational Safety Magazine)
- www.nationalcodes.ca/ (National Code Documents)
- www.theglobeandmail.com/ (The Globe and Mail Newspaper)
- www.nationalpost.com/ (National Post Newspaper)
- www.theguardian.pe.ca/ (The Guardian Newspaper)
- www.cbc.ca/pei/ (CBC-PEI)

TR1 Use Terminology of the Trade

Upon completion of this objective, learners will be able to:

- 1.1 identify strategies to organize and remember new terminology
 - use context clues to find the meaning of new terms
 - use word parts to create meaning
 - use trades glossary to find meaning of technical terms
 - use standard dictionary to find meaning of non-technical terms
- 1.2 implement strategies to organize and remember new terminology
 - define terms
 - use terminology in context

Suggested Strategies and Activities:

- Identify and define terms unique to the trade
- Highlight unfamiliar terms in trade-related reading
- Choose appropriate strategy to find meaning of unfamiliar terms
- Demonstrate understanding of new terms by using in sentences, providing examples or providing illustrations
- Create a personal dictionary
- Use graphic organizers to remember terms of the trade
- Interpret acronyms and abbreviations of the heating and cooling trades
- Use terminology as it applies to materials, schedules, and systems

Non-contextualized Resources:

- Shape Up Your Reading
- Cross Curricular Reading Tools (Vocabulary Study)
- Navigating Texts and Documents in Technical Training

Contextualized Resources:

- EARAT (Communications for Refrigeration and Air Conditioning Apprentices: Skill # 2)

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*
- Glossary of Housing Terms
- Building Trades Dictionary
- Blueprints and Plans for HVAC, *3rd Edition*
- Blueprint Reading and Drafting for Plumbers, *2nd Edition*
- HVACR 101
- Construction Drawings and Specifications, HVAC Level Four
- National Occupational Analyses (NOA) for Refrigeration and Air Conditioning mechanics and Oil Burner mechanics
- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://www.edu.gov.on.ca/ca/eng/studentsuccess/thinkliteracy/files/Reading.pdf>
(Reading Strategies for using context clues)

Online Glossaries:

- http://www.thehvacsource.com/index.php?q=glossary/hvac_terms
- http://www.hvacmechanic.com/glossary/glossary_a.htm
- http://heating.1800anytyme.com/info/heating_hvac_glossary.php
- <http://www.hvac-city.com/hv01002.htm>
- <http://www.maytaghvac.com/MTGloss.asp>
- <http://www.geocities.com/~jsphilly/hvacglossary.html>
- <http://www.brownsoilair.com/heatGlossary.html>
- <http://www.tradesinfo.ca/en/trade-information/oil-burner-mechanic/terminology>
- <http://www.harkerheating.com/glossary.php>
- <http://www.boiler-outlet.com/glossary.asp>

TR2 Use Strategies to Improve Understanding and Recall

Upon completion of this learning objective, learners will be able to:

- 2.1 identify strategies to improve understanding and recall of written information
 - use prior knowledge to make sense of new information
 - use SQ3R
 - use KWL
 - use note-taking strategies
 - use memory strategies
- 2.2 implement strategies to improve understanding and recall of written information

Suggested Strategies and Activities:

- Identify individual learning style
- Incorporate learning strategies for individual learning style for study and class participation
- Explain the steps to the SQ3R strategy
- Explain the steps to the KWL strategy
- Model strategies and encourage learners to incorporate SQ3R and KWL into reading activities
- Create and Use Charts for SQ3R and KWL
- Use KWL in group settings to introduce new concepts
- Apply techniques for note-taking and marking text
- Assess and modify personal study habits/environment to incorporate new strategies

Non-contextualized Resources:

- Navigating Texts and Documents in Technical Training
- Shape Up Your Reading
- Cross Curricular Reading Tools

Technical Resources:

- HVACR 101
- Blueprints and Plans for HVAC, 3rd Edition
- Blueprint Reading and Drafting for Plumbers, 2nd Edition
- Construction Drawings and Specifications, HVAC Level Four
- Modern Refrigeration and Air Conditioning, 18th Edition

- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://www.bucks.edu/~specpop/Lrnprfil.htm> (Learning Styles and Study Skills)
- <http://www.ldpride.net/learningstyles.MI.htm#Learning%20Styles%20Explained> (Learning Styles)
- <http://www.learning-styles-online.com/> (Learning Styles)
- http://www.support4learning.org.uk/education/learning_styles.cfm (Learning Styles)
- <http://www.studygs.net/> (Reading and Study Strategies)
- <http://www.khake.com/page3.html> (Study Skills)
- http://www.mindtools.com/pages/article/newISS_02.htm (SQ3R)
- http://www.mindtools.com/pages/main/newMN_ISS.htm (Reading and Study Skills)
- <http://www.edu.gov.on.ca/eng/studentssuccess/thinkliteracy/files/Reading.pdf> (Reading Strategies)

TR3 Read to Perform Job Tasks

Upon completion of this objective, learners will be able to:

- 3.1 identify purpose of reading information to perform job tasks
- 3.2 locate specific information
 - scan to locate specific information
 - locate information using organizational features of text
- 3.3 skim for overall meaning
- 3.4 read to understand and learn
- 3.5 read to critique
- 3.6 read to evaluate

Suggested Strategies and Activities:

- Use organizational features to predict content and relevance of text
- Locate information using key words
- Scan for information in trade-related material (i.e., texts, memos, newsletters, safety information, equipment manuals, codes and regulations)
- Practice skimming to get the main idea in reading material of the trade (i.e., texts, memos, newsletters, safety information, equipment manuals, codes, specifications and regulations)
- Use Table of Contents, Indices, Appendices, Headings and Sub-headings to locate information in material of the trade (i.e., texts, collective agreements, manuals, codes, specifications and regulations)
- Introduce structure and layout of various codebooks
- Use numbering system to identify exact location of information in various codebooks
- Read selections of text and provide a verbal or written summary
- Read specification sheets to determine project requirements
- Read installation manuals to follow procedures
- Compare the advantages and disadvantages of various tools or materials for a particular situation
- Interpret written procedures (i.e., housekeeping, first aid, handling toxic materials, , site safety, and confined space)
- Read Occupational Health and Safety regulations to determine safe work practices
- Read and interpret codes, regulations and standards for compliance

Non-contextualized Resources:

- Shape Up Your Reading
- Navigating Texts and Documents in Technical Training
- Cross Curricular Reading Tools
- Study Smarter, Not Harder

Contextualized Resources:

- EARAT (Communications for Refrigeration and Air Conditioning Apprentices: Skill # 1, 3, 4, 5, 7, 9-12)
- Applied Communication Skills for the Construction Trades

Technical Resources:

- National Building Code of Canada 2005, Volume 2 (12th edition)
- National Housing Code of Canada 1998 and Illustrated Guide
- National Plumbing Code of Canada 2005
- Canadian Electrical Code, handbook, and pocket reference
- Construction Drawings and Specifications, HVAC Level Four
- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*
- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://www.edu.gov.on.ca/eng/studentssuccess/thinkliteracy/files/Reading.pdf> (Reading Strategies)
- <http://www.keyskillssupport.net/teacandlearresoa/> (Learning Resources-see Construction Sector)
- <http://www.42explore.com/skim.htm> (Skimming and Scanning)
- <http://www.edu.gov.on.ca/eng/studentssuccess/thinkliteracy/files/Reading.pdf> (Strategies for Reading Graphical Text)
- www.open.ac.uk/skillsforstudy/active-reading.php (Active Reading)

TR4 Improve Examination Performance

Upon completion of this objective, learners will be able to:

- 4.1 identify barriers to successful examination performance
- 4.2 identify strategies to improve examination performance
 - identify ways to prepare for exams
 - identify test taking strategies
 - identify strategies to reduce test anxiety
- 4.3 implement strategies to improve examination performance

Note: Learners preparing for the Interprovincial Red Seal exam should review the National Occupational Analyses for Refrigeration and Air Conditioning mechanic and Oil Burner mechanic.

Suggested Strategies and Activities:

- Analyze past tests
- Provide opportunity to complete practice questions
- Provide information on testing locations and procedures for your province
- Refer to Appendices in NOA for Block and Task Weighting
- Discuss test-taking strategies
- Discuss strategies to reduce test anxiety
- Discuss steps in test preparation

Non-contextualized Resources:

- Shape Up Your Reading
- Study Smarter Not Harder
- National Electrical Trade Council (NETCO) Instructor's Guide: Test-Taking Strategies for Interprovincial Red Seal Exams (Generic Version)

Technical Resources:

- National Occupational Analyses for Refrigeration and Air Conditioning Mechanic and Oil Burner Mechanic
- Modern Refrigeration and Air Conditioning, 18th Edition
- Residential Oil Burners, 3rd Edition

Online Resources:

- http://www.red-seal.ca/Site/english/pdf/Oil_Burner_Mechanic_2006.pdf (NOA- Oil Burner Mechanic)
- http://www.johnrwhite.net/welcome_to%20hvac%20practice%20exam.htm (Practice HVAC Exam)
- http://www.red-seal.ca/Site/english/pdf/Refrigeration_and_Air_Conditioning_Mechanic_2004.pdf (NOA- Refrigeration and Air Conditioning Mechanic)
- www.cec.ca.org/netco (Preparing for Red Seal: Instructor Guide and Power Point Presentation)
- <http://www.itabc.ca/documents/Preparing%20For%20Success.pdf> (Preparing for the Red Seal Exam, BC Industry Training Authority)
- www.testtakingtips.com (Test-taking Skills)
- www.studygs.net/tsttak3.htm (Study and Test taking strategies)
- www.ucc.vt.edu/stdysk (Study Skills)
- www.d.umn.edu/kmc/student/loon/acad/strat/testcheck.html (Test Taking Checklist)
- www.uic.edu/depts/counselctr/ace/multiple.htm (Multiple Choice Test Strategies)
- www.collegeboard.com/student/testing/clep/prep_hint_mc.html (Multiple Choice Tips)

Appendix A

Resource Materials:

Applied Communications Skills for the Construction Trades

Steven A. Rigolosi
Pearson Education Inc. 2002
ISBN 0-13-093355-4

Blueprints and Plans for HVAC, 3rd Edition

Frank Miller, Wilma Miller, and Joseph Moravek
Delmar Cengage Learning, 2008
ISBN: 13-978-1-4283-3520-2

Blueprint Reading and Drafting for Plumbers 2nd Edition

Michael A. Joyce
Delmar, Cengage Learning, 2004
ISBN 13: 978-1-4283-3513-4

Building Trades Dictionary

American Technical Publishers
ISBN 0-8269-0405-X

Canadian Electrical Code, Part 1

Safety Standard for Electrical Installations, 20th Edition
Canadian Standards Association, 2006
ISBN: 1-55436-023-4

CE Code Handbook

An Explanation of Rules of the CE Code, Part 1
Canadian Standards Association, 2006
ISBN: 1-55436-024-2

CE Code Pocket Reference

Canadian standards Association, 2006
ISBN: 1-55436-134-6

Construction Drawings and Specifications, HVAC Level 4

Module 03401-03
Contren Learning Series
National Center for Construction Education and Research, 2003
ISBN: 0-13-867987-8

Cross Curricular Reading Tools

CAMET

P.O. Box 2044

Halifax, NS B3J 1M7

ISBN 1-895660-77-4

Evaluating Academic Readiness for Apprenticeship Training (EARAT)

Communications for Plumber Apprentices

Workplace Support Services Branch

Ontario Ministry of Training, Colleges and Universities, October 2000

Tel 416-325-2929 or 1-800-387-5514

Email: info@edu.gov.on.ca***Glossary of Housing Terms***

Canadian Mortgage and Housing Corporation

Tel 1-800-668-2642; Fax: 1-800-245-9274

ISBN 0-660-18603-9

www.cmhc.ca***HVACR101***

Air Conditioning Contractors of America

Plumbing-Heating-Cooling-Contractors

National Association Educational Foundation

Refrigeration Service Engineers Society

ISBN: 13-978-1-4180-6663-5

Instructor's Guide: Test-Taking Strategies for Interprovincial Red Seal Exams (Generic Version: Applicable to all Red Seal Trades)

National Electrical Trade Council (NETCO), 2008

www.ceca.org/netco***Modern Refrigeration and Air Conditioning, 18th Edition***

Andrew D. Althouse, Carl H. Turnquist, Alfred F. Bracciano

The Goodheart-Willcox Company, Inc.,

ISBN: 13-978-1-59070-280-2

ISBN (Instructor's Manual): 13-978-1-59070-283-3

ISBN (Study Guide): 13-978-1-59070-281-9

ISBN (Laboratory Manual): 13-978-1-59070-282-6

National Building Code of Canada 2005, Volume 2 (12th edition)

National Research Council Canada, 2005

ISBN: 0-660-19425-2

National Housing Code of Canada 1998 and Illustrated Guide

Institute for Research in Construction
National Research Council Canada, 1998
ISBN: 0-660-17653-X

National Plumbing Code of Canada 2005

Institute for Research in Construction
Client Services
1200 Montreal RD
Ottawa ON K1A 9Z9

Navigating Texts and Documents in Technical Training

Manitoba Competitiveness Training and Trade
Toll-Free: 1-877-978-7233 (1-877-97-TRADE)
Email: apprenticeship@gov.mb.ca

Residential Oil Burners, 3rd Edition

Herb Weinberger
Thomson Delmar Learning, 2008
ISBN: 13-978-1-4180-7397-8
ISBN (Instructor's Guide): 13-978-1-4180-7398-5

Shape Up Your Reading

Sheila Trant
Harcourt Brace & Company, Canada 1997
ISBN 0-7747-3296-2

Study Smarter, Not Harder

Kevin Paul
Self-Counsel Press 1996
ISBN 1-555180-059-4

All online resources listed in this document were operational at time of publication.

Document Use (DU) Learning Outcome: Learners will use strategies for locating, retrieving, interpreting, and entering information in/from documents and will create trade documents

DU 1 Use Lists	1.1 Define lists	1.2 Identify purpose	1.3 Locate information in lists	1.4 Interpret information in lists	1.5 Create lists	1.6 Evaluate lists for effectiveness
DU 2 Use Tables	2.1 Define tables	2.2 Identify purpose	2.3 Locate information in tables	2.4 Interpret information in tables	2.5 Create tables	2.6 Evaluate tables for effectiveness
DU 3 Use Forms	3.1 Define forms	3.2 Identify purpose	3.3 Locate information in forms	3.4 Interpret information in forms	3.5 Enter information into forms	3.6 Create forms
	3.7 Evaluate forms for effectiveness					
DU 4 Use Charts	4.1 Define charts	4.2 Identify purpose	4.3 Locate information in charts	4.4 Interpret information in charts	4.5 Create charts	4.6 Evaluate charts for effectiveness
DU 5 Use Graphic Documents	5.1 Define graphic documents	5.2 Identify purpose	5.3 Locate information in graphic documents	5.4 Interpret information in graphic documents	5.5 Create graphic documents	5.6 Evaluate graphic documents for effectiveness

Learners will use strategies for locating, retrieving, interpreting and entering information in/from documents and for creating trade documents

Introduction

Document Use (DU) tasks involve the process of locating, organizing and using information in different visual displays that include words, numbers and diagrams. These visual materials efficiently summarize large amounts of information in a small amount of space and are widely used in trade occupations.

Apprentices must be proficient document users if they are to be successful in technical training and in job performance. This guide has been developed to provide apprentices with strategies to use trade documents quickly, efficiently, and accurately. Learners will locate, interpret, and evaluate information in documents and will create documents common to their trade. Understanding document structure and the strategies for using them will lead to more efficient information processing. For the purpose of the Trade Essentials project, documents have been categorized and defined as follows:

- **List** – A document that records items in a row.
- **Table** – A document that arranges information in rows and columns.
- **Form** – A document which contains blanks for the insertion of pre-specified information.
- **Chart** – A document that is used primarily to make large quantities of data easier to understand, illustrates the relationship between different parts of the data, and commonly presents information as plots with reference to an axis. Charts are generally graphical in nature and contain very little text. Examples of charts include pie chart, flow chart, bar graph, line graph, histogram, and pictogram.
- **Graphic Document** – A document which portrays information as an imitation of the real world. Examples of graphic documents include pictures, diagrams, drawings, blueprints, schematics, maps, symbols, signs, and icons.

The following guide outlines a list of recommended resources (see Appendix A) for each objective in the Document Use curriculum framework and, where possible, includes online website materials that complement these resources. Three formats are provided to allow learners the opportunity to review competencies in a way that best suit their needs. These resources are categorized as follows:

- **Non-contextualized** - Curriculum resources that are **not** related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials.
- **Contextualized** - Curriculum resources that provide Essential Skills applications in the context of a specific trade or occupation.
- **Technical** - Trade training materials from which Essential Skills are extracted.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose materials and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Document Use in the Heating and Cooling Trades

Refrigeration and Air Conditioning mechanics and Oil Burner Mechanics use documents on a daily basis to complete job tasks. According to Human Resources and Skills Development Canada's Essential Skills Profile (<http://srv108.services.gc.ca/>), the complexity of the tasks performed by refrigeration and air conditioning mechanics ranges from using very simple, brief text combined with uncomplicated structure (i.e., review equipment lists to find part numbers) to using complex documents with multiple pieces of information organized into multiple sections (i.e., interpret blueprints to determine sites for equipment installation). Though no Essential Skills profile exists for oil burner mechanics, information gleaned from the trade's National Occupational Analysis suggests that the complexity of the tasks performed by oil burner mechanics correlates with that of refrigeration and air conditioning mechanics.

Both Refrigeration and air conditioning mechanics and oil burner mechanics interpret blueprints to determine the layout of heating and/or cooling systems. Additionally, they read and interpret shop drawings, sketches, wiring diagrams, component schematics, and specifications. Interpretation of many of these documents requires knowledge of drawing components such as lines, symbols and legends and schedules.

Refrigeration and air conditioning mechanics and oil burner mechanics must be familiar with and apply Occupational Health and Safety Acts, Workplace Hazardous Material Information System (WHMIS) regulations, and Transportation of Dangerous Goods (TDG) regulations to both determine workplace hazards and

ensure protection for themselves, their co-workers, the public, and the environment.

For background information on Document Use and how documents are used in the heating and cooling trades, visit these sites:

- http://srv108.services.gc.ca/awm/main/c_tf_doc1_e.shtml#whatis (Understanding Document Use- Human Resource Skills Development Canada)
- http://www.red-seal.ca/Site/trades/analyst_e.htm (The Interprovincial Standards Red Seal Program)
- http://www.thelearningpartnership.ca/Passport_to_Prosperty/onlineresources_teacher/UsingDocuments.pdf (Background Information on Document Use)

The following websites contain heating and cooling-related content which may be used as an additional document use forum.

Heating and Cooling-Related Online Websites:

- www.plumbingandhvac.ca/ (Plumbing and HVAC Information)
- www2.worksafebc.com/Portals/Construction/Home.asp?_from=construction.healthandsafetycentre.org (Preventing injuries and illnesses in construction trades)
- www.advancedbuildings.org/ (Advanced Buildings)
- www.allhvacinfo.com/ (Directory of HVAC Information)
- www.hvacmechanic.com/ (General HVAC Information)
- www.hvacportal.com/ (HVAC-related Information on Various Topics)
- www.ciph.com/Your_Industry_Trade_Section/About_Us/ (Canadian Institute of Plumbing and Heating)
- www.mcac.ca/ (Mechanical Contractors Association of Canada)
- www.phccweb.org/ (Plumbing Heating Cooling Contractors Association)
- www.ashrae.org/ (American Society of Heating, Refrigeration, and Air Conditioning Engineers)
- www.coha.ca/ (Canadian Oil Heat Association)
- www.hrai.ca/ (The Heating, Refrigeration, and Air Conditioning Institute of Canada)
- www.alternative-heating.com/waste-oil-burner.html (Waste Oil Burner Basics)
- www.hvacmechanic.com/heating/sequence_of_operation_for_an_oil.htm (HVAC Mechanic.com)
- www.abma.com/ (American Boiler Manufacturers Association)
- www.coha.ca/ (Canadian Oil Heat Association)
- www.heatpumpcentre.org/ (Heat Pump Information)

General Websites:

- www.red-seal.ca/Site/index_e.htm (The Interprovincial Standards Red Seal Program)
- www.ccohs.ca/ (Canadian Centre for Occupational Health and Safety)
- www.hrsdc.gc.ca/en/labour/workplace_health/index.shtml (Workplace Health and Safety)
- www.hrsdc.gc.ca/en/hip/hrp/essential_skills/essential_skills_index.shtml (Human Resources and Social Development Canada-Essential Skills Website)
- www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php (WHMIS)
- www.wcb.pe.ca/index.php3?number=60189 (Worker's Compensation Board of PEI)
- www.gov.pe.ca/educ/index.php3?number=74951 (PEI Apprenticeship Training)
- www.irc.nrc-cnrc.gc.ca/codes/home_E.shtml (Canadian Codes Centre)
- www.canoshweb.org/ (Canada's National Occupational Health and Safety Website)
- www.oshweb.com/ (Index of Occupational Health and Safety Resources)
- www.iapa.on.ca/about_iapa/about_intro.asp (Industrial Accident Prevention Association)
- www.cos-mag.com/ (Canadian Occupational Safety Magazine)
- www.nationalcodes.ca/ (National Code Documents)

DU1 Use Lists

Upon completion of this objective, learners will be able to:

- 1.1 define lists
- 1.2 identify purpose
- 1.3 locate information in lists
- 1.4 interpret information in lists
- 1.5 create lists
- 1.6 evaluate lists for effectiveness

Suggested Strategies and Activities:

- Identify presence and uses of lists in documents of the trade
- Find examples and extract information from the four types of lists (simple, combined, intersected and nested)
- Create lists to organize and compare information by category (i.e., tools, materials and special equipment for each installation)
- Create material lists from specification sheets
- Differentiate between lists and tables
- Analyze lists and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of lists
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents - A Guide to Information Display in the Workplace
- Field Safety, Volume One
- Document Use Refresher for Apprentices (Module 2)
- Carpenter-Related Essential Skills Resource Binder
- Applied Communication Skills for the Construction Trades

Contextualized Resources:

- IPT's Safety First Handbook (Book One)

Technical Resources:

- HVACR 101
- Blueprints and Plans for HVAC, *3rd Edition*
- Construction Drawings and Specifications, HVAC Level Four
- Modern Refrigeration and Air Conditioning, *18th Edition*
- Residential Oil Burners, *3rd Edition*

DU2 Use Tables

Upon completion of this objective, learners will be able to:

- 2.1 define tables
- 2.2 identify purpose
- 2.3 locate information in tables
- 2.4 interpret information in tables
- 2.5 create tables
- 2.6 evaluate tables for effectiveness

Suggested Strategies and Activities:

- Brainstorm to identify the use of tables in the trade
- Gather samples of tables from job sites
- Create tables to sort and separate materials, supplies and equipment
- Analyze tables and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of tables
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- Field Safety, Volume One
- Workplace Communications-The Basics, *3rd Edition* (Chapter 3)
- Applied Communication Skills for the Construction Trades
- Carpenter-Related Essential Skills Resource Binder

Contextualized Resources:

- Blueprints and Plans for HVAC, *3rd Edition*
- IPT's Safety First Handbook (Book One)

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*
- National Housing Code of Canada 1998 and Illustrated Guide
- National Building Code of Canada 2005, Volume 2

- Canadian Electrical Code, Part 1
- CE Code Handbook
- CE Code Pocket Reference
- National Plumbing Code of Canada 2005
- HVACR 101
- Construction Drawings and Specifications, HVAC Level Four

DU3 Use Forms

Upon completion of this objective, learners will be able to:

- 3.1 define forms
- 3.2 identify purpose
- 3.3 locate information in forms
- 3.4 interpret information in forms
- 3.5 enter information into forms
- 3.6 create forms
- 3.7 evaluate forms for effectiveness

Suggested Strategies and Activities:

- Define entry forms as documents which both share information and require input of information
- Identify features common to workplace forms
- Identify audience for workplace forms
- Interpret vocabulary of workplace forms
- Extract information from forms common to the trade (i.e., accident/incident reports, expense forms, daily time sheets, daily logs, invoices, application forms, building permits, purchase orders and material take off sheets)
- Define entry forms as documents which both share information and require input of information
- Use title of form to predict purpose and kinds of information requested
- Distinguish between primary and secondary information
- Enter information into forms common to the trade (i.e., accident/incident reports, expense forms, daily time sheets, daily logs, invoices, application forms, building permits, purchase orders and material take off sheets)
- Analyze forms and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of forms
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Document Use Refresher for Apprentices (Module 6)
- A Tool Box of Reading Activities-Supplementary Teaching Resources- Apprenticeship Branch of Manitoba Competitiveness Training and Trade
- Writing at Work (Module 2-Entry Forms)
- Tools for Success- Soft Skills for the Construction Industry
- Carpenter-Related Essential Skills Resource Binder (Module 1)

Contextualized Resources:

- Practical Problems in Mathematics for Heating and Cooling Technicians

Technical Resources:

- Construction Drawings and Specifications, HVAC Level Four

Online Resources:

- http://www.gov.pe.ca/photos/original/edu_appl_appren.pdf (Application for Apprenticeship)
- <http://www.wcb.pe.ca/index.php3?number=60190&lang=E> (Workers Compensation Forms)
- <http://www.about-building-in-canada.com/building-permit.html> (Building in Canada: Permits and Codes)
- <http://www.gov.pe.ca/infopei/index.php3?number=13766> (Info PEI-Building Permits)
- <http://www.obc.mah.gov.on.ca/AssetFactory.aspx?did=792> (Building Permits)
- <http://ww3.whitehorse.ca/Planning/guides/building%20permit%20process.pdf> (Building Permits)
- <http://www.abcaforms.com/allstates.html> (Examples of Construction Forms)
- http://books.google.ca/books?id=DBhILgGvCakC&pg=PA36&lpg=PA36&dq=how+to+complete+construction+invoices&source=web&ots=RLEjAHWmQ9&sig=UTLvWpFGyC5mWNYPWNnLOIWy1CU&hl=en&sa=X&oi=book_result&resnum=1&ct=result (Examples of Forms)

DU4 Use Charts

Upon completion of this objective, learners will be able to:

- 4.1 define charts
- 4.2 identify purpose
- 4.3 locate information in charts
- 4.4 interpret information in charts
- 4.5 create charts
- 4.6 evaluate charts for effectiveness

Suggested Strategies and Activities:

- Identify the presence and use of charts in the trade
- Identify the basic types: pie chart, bar graph and line graph, etc. and in what circumstance each may be used
- Discuss the use of charts in a variety of trade-related and safety workplace documents
- Review workplace charts common to the trade
- Analyze charts and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of charts
- Encourage learners to share their knowledge and experiences
- Discuss charts as a useful way to compare numerical data
- Define charts as visual organizers of data

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Field Safety, Volume One
- Document Use Refresher for Apprentices (Modules 4 and 5)
- Workplace Communications-The Basics, 3rd Edition (Chapter 3)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- Practical Problems in Mathematics for Heating and Cooling Technicians

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*
- HVACR 101
- Construction Drawings and Specifications, HVAC Level Four
- Residential Oil Burners, *3rd Edition*

Online Resources:

- https://www.advancededucation.gov.ab.ca/k_12/curriculum/bysubject/ke/Readtolive/Tools/Reading%20Diagrams.pdf (Reading Charts and Graphs)
- http://www42.statcan.ca/smr02/smr02_022_e.htm (Statistics Canada)
- <http://www.constructionforecasts.ca/oft/graph?preset=215> Construction Sector Council (Graphs and Tables)
- <http://www.gdsourcing.ca/works/Construct.htm> (Canadian Construction Association)

DU5 Use Graphic Documents

Upon completion of this objective, learners will be able to:

- 5.1 define graphic documents
- 5.2 identify purpose
- 5.3 locate information in graphic documents
- 5.4 interpret information in graphic documents
- 5.5 create graphic documents
- 5.6 evaluate graphic documents for effectiveness

Suggested Strategies and Activities:

- Display documents common to the trade (i.e., signs, labels, codes, schematics, collective agreements, safety information, maps, product catalogues, installation manuals, scale drawings and blueprints)
- Identify symbols commonly used in the trade including WHMIS
- Interpret signs for safety information
- Interpret product or packaging labels
- Recognize lines used on drawings
- Recognize significance of symbols
- Take measurements from drawings
- Create schedules to coordinate with other trades
- Construct drawings (i.e., site, architectural, system)
- Use geometry tools to create common angles and shapes
- Make sketches to communicate ideas for changes in existing plans
- Practice drawing to scale using metric and imperial systems
- Analyze graphic documents and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of graphic documents
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Field Safety, Volume One
- Document Use Refresher for Apprentices (Modules 1 and 3)
- Carpenter-Related Essential Skills Resource Binder
- Workplace Communications-The Basics, *3rd Edition* (Chapter 3)
- Applied Communication Skills for the Construction Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- Blueprint Fundamentals: Interpreting Symbols and Specs (CD-ROM)
- EARAT (Communication Skills for Refrigeration and Air Conditioning Apprentices: Skill #6)
- Print Reading for Construction – Residential and Commercial
- Blueprints and Plans for HVAC, *3rd Edition*
- IPT's Safety First Handbook (Book One)

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*
- HVACR 101
- Construction Drawings and Specifications, HVAC Level Four
- Reading and Interpreting Ladder Diagrams (CD)
- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://highperformancehvac.com/> (High Performance HVAC)
- <http://www.tpub.com/content/draftsman/14040/> (Integrated Publishing-Drafting)
- <http://www.smjconstruction.com/subcontractors/documents/14H-0.pdf> (HVAC/Plumbing Symbols)

Appendix A

Resource Materials:

Applied Communications Skills for the Construction Trades

Stephan A. Rigolosi
Pearson Education Inc. 2002
ISBN 0-13-093355-4

A Toolbox of Reading Activities with Authentic Documents of the Carpentry Trade

Manitoba Competitiveness Training and Trade
Toll-Free: 1-877-978-7233 (1-877-97-TRADE)
Email: apprenticeship@gov.mb.ca

Blueprint Fundamentals: Interpreting Symbols and Specs (CD-ROM)

Shopware, 2004
www.shopware-usa.com

Blueprints and Plans for HVAC, 3rd Edition (and Drawings)

Frank Miller, Wilma Miller and Joseph Moravek
Delmar Cengage Learning, 2008
ISBN: 13-978-1-4283-3520-2

Canadian Electrical Code, Part 1

Safety Standard for Electrical Installations, 20th Edition
Canadian Standards Association, 2006
ISBN: 1-55436-023-4

Carpenter-Related Essential Skills Resource Binder

Manitoba Competitiveness Training and Trade
Tel 1-877-978-7233 (1-877-97-TRADE)
Email: apprenticeship@gov.mb.ca

CE Code Handbook

An Explanation of Rules of the CE Code, Part 1
Canadian Standards Association, 2006
ISBN: 1-55436-024-2

CE Code Pocket Reference

Canadian standards Association, 2006
ISBN: 1-55436-134-6

Construction Drawings and Specifications, HVAC Level 4

Module 03401-03

Contren Learning Series

National Center for Construction Education and Research, 2003

ISBN: 0-13-867987-8

Document Use Refresher for Apprentices

Nova Scotia Department of Education

Apprenticeship Training and Skills Development

Tel: 902-424-0492

Evaluating Academic Readiness for Apprenticeship Training (EARAT)

Communications for Refrigeration and Air Conditioning Apprentices

Workplace Support Services Branch

Ontario Ministry of Training, Colleges and Universities, October 2000

Tel 416-325-2929 or 1-800-387-5514

Email: info@edu.gov.on.ca

Field Safety Volume One

Participant Guide

Contren Learning Series

National Center for Construction Education and Research, 2003

ISBN: 0-13-106760-5

HVACR101

Air Conditioning Contractors of America

Plumbing-Heating-Cooling-Contractors

National Association Educational Foundation

Refrigeration Service Engineers Society

ISBN: 13-978-1-4180-6663-5

IPT's Safety First Handbook (Book One)

Bruce M. Basaraba

IPT Publishing and Training Ltd., 1999

ISBN: 0-920855-34-2

Modern Refrigeration and Air Conditioning, 18th Edition

Andrew D. Althouse, Carl H. Turnquist, Alfred F. Bracciano

The Goodheart-Willcox Company, Inc.,

ISBN: 13-978-1-59070-280-2

ISBN (Instructor's Manual): 13-978-1-59070-283-3

ISBN (Study Guide): 13-978-1-59070-281-9

ISBN (Laboratory Manual): 13-978-1-59070-282-6

National Building Code of Canada 2005, Volume 2 (12th edition)

National Research Council Canada, 2005
ISBN: 0-660-19425-2

National Housing Code of Canada 1998 and Illustrated Guide

Institute for Research in Construction
National Research Council Canada, 1998
ISBN: 0-660-17653-X

National Plumbing Code of Canada 2005

Institute for Research in Construction
Client Services
1200 Montreal RD
Ottawa ON K1A 9Z9

Practical Problems in Mathematics for Heating and Cooling Technicians, 5th Edition

Russel De Vore
Delmar, Cengage Learning, 2009
ISBN: 13-978-1-4483-2428-2t

Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Jack Martin & Mary Serich
Jack Martin and Associates, 2006
ISBN: 0-9649530-1-3

Print Reading for Construction – Residential and Commercial

Walter C. Brown
Daniel P. Dorfmueller
The Goodheart-Willcox Company, Inc., 2005
ISBN: 13-978-1-59070-347-2

The Language of Documents- A Guide to Information Display in the Workplace

Lynda Fownes
Skillplan – The B.C. Construction Industry Skills Improvement Council, 1999
ISBN: 0-9685027-0-9

Reading and Interpreting Ladder Diagrams (CD)

Jim Pettit
The Goodheart-Willcox Company, Inc., 2007
ISBN: 978-1-59070-783-8

Residential Oil Burners, 3rd Edition

Herb Weinberger

Thomson Delmar Learning, 2008

ISBN: 13-978-1-4180-7397-8

ISBN (Instructor's Guide): 13-978-1-4180-7398-5

Tools for Success- Soft Skills for the Construction Industry

Stephen A. Rigolosi

Pearson Education Inc. 2004

ISBN 0-13-160000-1

Workplace Communications-The Basics, Third Edition

George J. Searles

Pearson Education, Inc., 2006

ISBN: 0-321-33068-4

Writing at Work

Sue Grecki, Sheila Whincup

Skillplan- The BC Construction Skills Improvement Council 1996

ISBN 0-9685027-4-1

All online resources listed in this document were operational at time of publication.

Principles of Mathematics (PM) Learning Outcome – Learners will understand, interpret, and manipulate mathematical concepts in order to solve problems and complete job tasks.

**PM1 Use
Calculators**

1.1 Identify the benefits and risks involved in using calculators in the trade	1.2 Describe how calculators are used in the trade	1.3 Determine the best calculator for the trade	1.4 Use calculators to solve problems
--	--	---	---------------------------------------

**PM2 Use Positive
and Negative
Numbers**

2.1 Read positive and negative numbers	2.2 Write positive and negative numbers	2.3 Round positive and negative numbers	2.4 Estimate positive and negative numbers	2.5 Order positive and negative numbers	2.6 Compare positive and negative numbers
2.7 Add positive and negative numbers	2.8 Subtract positive and negative numbers	2.9 Multiply positive and negative numbers	2.10 Divide positive and negative numbers	2.11 Use knowledge of positive and negative numbers to solve problems	

**PM3 Use Order
of Operations**

3.1 Identify the necessary steps in performing order of operations	3.2 Calculate answers Using correct order of operations	3.3 Use order of operations to solve problems
--	---	---

**PM4 Use
Fractions**

4.1 Read fractions	4.2 Write fractions	4.3 Compare fractions	4.4 Round fractions	4.5 Simplify fractions	4.6 Add fractions
4.7 Subtract fractions	4.8 Multiply fractions	4.9 Divide fractions	4.10 Use knowledge of fractions to solve problems		

**PM5 Use Mixed
Numbers**

5.1 Read mixed numbers	5.2 Write mixed numbers	5.3 Compare mixed numbers	5.4 Round mixed numbers	5.5 Simplify mixed numbers	5.6 Add mixed numbers
5.7 Subtract mixed numbers	5.8 Multiply mixed numbers	5.9 Divide mixed numbers	5.10 Use knowledge of mixed numbers to solve problems		

**PM6 Use
Decimals**

6.1 Read decimals	6.2 Write decimals	6.3 Estimate decimals	6.4 Round decimals	6.5 Add decimals	6.6 Subtract decimals
6.7 Multiply decimals	6.8 Divide decimals	6.9 Use knowledge of decimals to solve problems			

PM7 Use Percent

7.1 Use formulae to calculate percent	7.2 Use knowledge of percent to solve problems
---------------------------------------	--

**PM8 Use
Conversion**

8.1 Explain the purpose of mathematical conversion	8.2 Convert among fractions, decimals, and percent	8.3 Use automatic recall of decimal and percent equivalents of common fractions	8.4 Use knowledge of conversion to solve problems
--	--	---	---

**PM9 Use
Measurement
Systems**

9.1 Demonstrate
uses of specific
measurements

9.2 Perform
conversions
within the metric
measurement
system

9.3 Perform
conversions
within the
imperial
measurement
system

9.4 Perform
conversions
between the
metric and
imperial
measurement
systems

9.5 Perform time
conversions

9.6 Use
knowledge of
measurement and
time conversion
to solve problems

**PM10 Use Rate,
Ratio, and
Proportion**

10.1 Describe the
differences
among rate, ratio,
and proportion

10.2 Give
examples of how
rate, ratio, and
proportion, are
used in the trade

10.3 Write
numbers as
proportions

10.4 Use
knowledge of rate
to solve problems

10.5 Use
knowledge of
ratio to solve
problems

10.6 Use
knowledge of
proportion to
solve problems

**PM11 Use
Square Root and
Exponents**

11.1 Determine
square root of
positive numbers
that are perfect
squares

11.2 Determine
approximate
square root of
positive numbers
that are not
perfect squares

11.3 Use
knowledge of
square root to
solve problems

11.4 Use
knowledge of
exponent laws to
solve problems

11.5 Determine
significant digits

11.6 Use
knowledge of
scientific notation
to solve problems

**PM12 Solve
Equations**

12.1 Write
variable
expressions and
equations from
sentences

12.2 Simplify
variable
expressions

12.3 Write
equations from
sentences

12.4 Solve one-
step equations

12.5 Solve two-
step equations

12.6 Solve multi-
step equations

**PM13 Use Trade-
Related
Formulae**

13.1 Identify
formulae
common to the
trade

13.2 Solve
problems using
formulae as
written

13.4 Solve
problems by
rearranging
formulae

**PM14 Use
Estimation**

14.1 Identify
estimation rules

14.2 Use
estimation rules
to solve single-
step problems

14.3 Use
estimation rules
to solve multi-step
problems

PM15 Use Angles

15.1 Identify
various types of
angles common to
the trade

15.2 Compare
angles common
to the trade

15.3 Measure
angles

15.4 Use
knowledge of
angles to solve
problems

**PM16 Use
Geometric
Shapes**

16.1 Identify
geometric shapes

16.2 Use
knowledge of
geometric
shapes to solve
problems

**PM17 Use
Trigonometry**

17.1 Identify the
value of
trigonometry in
the trade

17.2 Set Up
trigonometric
ratios

17.3 Use
trigonometric
functions to solve
problems

**PM18 Analyze
Numerical Data**

18.1 Identify ways
to organize data

18.2 Organize
information into
charts and
graphs

18.3 Extract
information from
charts and graphs

18.4 Evaluate
information
found in charts
and graphs

18.5 Make
predictions and
draw conclusions

	Automotive Service Tech	Carpenter	Cabinet Maker	Construction Electrician	Cook	Industrial Electrician	Machinist
PM1 Use Calculators	✓	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	Whole numbers only	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓	✓
PM7 Use Percent	✓	✓	✓	✓	✓	✓	✓
PM8 Use Conversion	✓	✓	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	✓	✓	✓	✓	✓	✓	✓
PM11 Use Square Root and Exponents	✓	✓	-	✓	-	✓	✓
PM12 Solve Equations	✓	✓	✓	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	-	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	-	✓	✓
PM18 Analyze Numerical Data	✓	-	-	-	✓	-	✓

	Metal Fabricator	Plumber	Refrigeration & Air Conditioning Mechanic	Oil Burner Mechanic	Steamfitter/ Pipefitter	Welder
PM1 Use Calculators	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓
PM7 Use Percent	-	-	✓	✓	✓	✓
PM8 Use Conversion	-	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	-	No proportion	✓	✓	✓	No proportion
PM11 Use Square Root and Exponents	-	-	✓	✓	✓	✓
PM12 Solve Equations	-	Plus quadratic equations	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	✓	✓
PM18 Analyze Numerical Data	-	-	✓	✓	-	-

The following checklist represents an overview of the Essential Skills necessary for Refrigeration and Air Conditioning/Oil Burner apprentices and identifies areas requiring review.

Learner Name: _____

Instructor Name: _____

Inventory Date: _____

Post-Inventory Date: _____

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					
OBJECTIVE 1: USE CALCULATORS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.1 Identify the risks and benefits involved in using calculators in the trade					
1.2 Describe how calculators are used in the trade					
1.3 Determine the best calculator for the trade					
1.4 Use knowledge of calculators to solve problems					
OBJECTIVE 2: USE POSITIVE AND NEGATIVE NUMBERS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1 Read positive and negative numbers					
2.2 Write positive and negative numbers					
2.3 Round positive and negative numbers					
2.4 Estimate positive and negative numbers					
2.5 Order positive and negative numbers					
2.6 Compare positive and negative numbers					
2.7 Add positive and negative numbers					
2.8 Subtract positive and negative numbers					
2.9 Multiply positive and negative numbers					
2.10 Divide positive and negative numbers					
2.11 Use knowledge of positive and negative numbers to solve problems					
OBJECTIVE 3: USE ORDER OF OPERATIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1 Identify the necessary steps in performing order of operations					
3.2 Calculate answers using correct order of operations					
3.3 Use order of operations to solve problems					

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					

OBJECTIVE 4: USE FRACTIONS

- 4.1 Read fractions
- 4.2 Write fractions
- 4.3 Compare fractions
- 4.4 Round fractions
- 4.5 Simplify fractions
- 4.6 Add fractions
- 4.7 Subtract fractions
- 4.8 Multiply fractions
- 4.9 Divide fractions
- 4.10 Use knowledge of fractions to solve problems

☐ ☐ ☐ ☐ ☐

OBJECTIVE 5: USE MIXED NUMBERS

- 5.1 Read mixed numbers
- 5.2 Write mixed numbers
- 5.3 Compare mixed numbers
- 5.4 Round mixed numbers
- 5.5 Simplify mixed numbers
- 5.6 Add mixed numbers
- 5.7 Subtract mixed numbers
- 5.8 Multiply mixed numbers
- 5.9 Divide mixed numbers
- 5.10 Use knowledge of mixed numbers to solve problems

☐ ☐ ☐ ☐ ☐

OBJECTIVE 6: USE DECIMALS

- 6.1 Read decimals
- 6.2 Write decimals
- 6.3 Estimate decimals
- 6.4 Round decimals
- 6.5 Add decimals
- 6.6 Subtract decimals
- 6.7 Multiply decimals
- 6.8 Divide decimals
- 6.9 Use knowledge of decimals to solve problems

☐ ☐ ☐ ☐ ☐

OBJECTIVE 7: USE PERCENT

- 7.1 Use formulae to calculate percent
- 7.2 Use knowledge of percent to solve problems

☐ ☐ ☐ ☐ ☐

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					
OBJECTIVE 8: USE CONVERSION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.1 Explain the purpose of mathematical conversion					
8.2 Convert among fractions, decimals and percents					
8.3 Use automatic recall of decimal and percent equivalents of common fractions					
8.4 Use knowledge of conversion to solve problems					
OBJECTIVE 9: USE MEASUREMENT SYSTEMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.1 Demonstrate uses of specific measurements					
9.2 Perform conversions within the Metric Measurement System					
9.3 Perform conversions within the Imperial Measurement System					
9.4 Perform conversions between the Metric and Imperial Measurement System					
9.5 Perform time conversions					
9.6 Use knowledge of measurement and time conversion to solve problems					
OBJECTIVE 10: USE RATE, RATIO AND PROPORTION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.1 Describe the differences among rate, ratio and proportion					
10.2 Give examples of how rate, ratio and proportion are used in the trade					
10.3 Write numbers as proportions					
10.4 Use knowledge of rate to solve problems					
10.5 Use knowledge of ratio to solve problems					
10.6 Use knowledge of proportion to solve problems					
OBJECTIVE 11 USE SQUARE ROOT AND EXPONENTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.1 Determine the square root of positive numbers that are perfect squares					
11.2 Determine approximate square root of positive numbers that are not perfect squares					
11.3 Use knowledge of square root to solve problems					
11.4 Use knowledge of exponent laws to solve problems					
11.5 Determine significant digits					
11.6 Use knowledge of scientific notation to solve problems					
OBJECTIVE 12: SOLVE EQUATIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.1 Write variable expressions and equations from sentences					
12.2 Simplify variable expressions					
12.3 Write equations from sentences					
12.4 Solve one-step equations					
12.5 Solve two-step equations					
12.6 Solve multi-step equations					

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					
OBJECTIVE 13: USE TRADE-RELATED FORMULAE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.1 Identify formulae common to the trade					
13.2 Solve problems using formulae as written					
13.3 Solve problems by rearranging formulae					
OBJECTIVE 14: USE ESTIMATION					
14.1 Identify estimation rules					
14.2 Use estimation rules to solve single-step problems					
14.3 Use estimation rules to solve multi-step problems					
OBJECTIVE 15: USE ANGLES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.1 Identify various types of angles common to the trade					
15.2 Compare angles common to the trade					
15.3 Measure angles					
15.4 Use knowledge of angles to solve problems					
OBJECTIVE 16: USE GEOMETRIC SHAPES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.1 Identify geometric shapes					
16.2 Use knowledge of geometric shapes to solve problems					
OBJECTIVE 17: USE TRIGONOMETRY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.1 Identify the value of trigonometry in the trade					
17.2 Set up trigonometric ratios					
17.3 Use trigonometric functions to solve problems					
OBJECTIVE 18: ANALYZE NUMERICAL DATA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.1 Identify ways to organize data					
18.2 Organize information into charts and graphs					
18.3 Extract information from charts and graphs					
18.4 Evaluate information found in charts and graphs					
18.5 Make predictions and draw conclusions					

Comments:

Assessor/s Signature

Date

Learners will understand, interpret and manipulate mathematical concepts in order to solve problems and complete tasks.

Introduction

The Principles of Mathematics (PM) is an introduction to the foundational skills necessary for successful technical training and effective job task completion. The intent of the course is twofold: to review and to further develop the concepts and strategies necessary for solving problems and completing tasks in the heating and cooling trades.

The following guide outlines a list of recommended resources (see Appendix A) for each objective in the mathematics curriculum framework and, where possible, includes online website materials that complement these resources. Three formats are provided to allow learners the opportunity to review competencies in a way that best suits their needs. These resources are categorized as follows:

- **Non-contextualized** - Curriculum resources that are **not** related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials.
- **Contextualized** - Curriculum resources that provide Essential Skills applications in the context of a specific trade or occupation.
- **Technical** - Trade training materials from which Essential Skills are extracted. For the purpose of the Trade Essentials project, ***Modern Refrigeration and Air Conditioning, 18th Edition*** by Andrew D. Althouse, Carl H. Turnquist, and Alfred F. Bracciano was used as the primary technical resource.

The information presented here has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose materials and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Refrigeration and Air Conditioning Mechanics, Oil Burner Mechanics and Numeracy

Refrigeration and air conditioning mechanics often use the skills outlined in the Principles of Mathematics on a daily basis to complete job tasks. The complexity of these tasks, according to Human Resources and Skills Development Canada's Essential Skills profile (<http://srv108.services.gc.ca/>), ranges from simple, clearly-defined mathematical operations (i.e., measuring lengths of ducting and piping using a tape measure) to tasks that involve multiple steps of calculation which may require advanced mathematical techniques (i.e., calculating the internal area of a closed piping system to determine the volume of refrigerant required in a system).

Though no Essential Skills profile exists for oil burner mechanics, information gleaned from the trade's National Occupational Analysis suggests that the complexity of the tasks performed by oil burner mechanics correlates with that of refrigeration and air conditioning mechanics.

Both refrigeration and air conditioning mechanics and oil burner mechanics perform calculations when measuring and testing equipment and when performing distribution layout. They take measurements to determine fuel storage tank locations and to cut and crimp piping when connecting vent/exhaust piping to appliances. Performing tasks such as installing appliances and components and installing heating systems requires a grounded knowledge of mathematical concepts.

Contextualized Online Resources:

- <http://www.vbisd.org/vbisd/site/default.asp> (Math for Construction Trades 2002)
- [http://www.rtc.edu/CCE/Resources/Products/MathToolBox/files/MATH%20BOOK 1017.A.pdf](http://www.rtc.edu/CCE/Resources/Products/MathToolBox/files/MATH%20BOOK%201017.A.pdf) (Laying the Foundation: Construction Math)
- <http://www.swtc.edu:8082/mscenter/apldmath.htm> (Applied Math Workbook)

PM1 Use Calculators

Upon completion of this objective, learners will be able to:

- 1.1 identify the risks and benefits involved in using calculators in the trade
- 1.2 describe how calculators are used in the trade
- 1.3 determine the best calculator for the trade
- 1.4 use knowledge of calculators to solve problems

Note: Calculators are used to improve speed and accuracy of calculations; however, it is important to note that calculators are tools and are only accurate if they are used properly. It is very important to have an understanding of order of operations when using calculators.

Only resources that specifically refer to calculators are outlined here. However, calculator use skills should be practiced with all identified resources.

Non-contextualized Resources:

- Introductory Technical Mathematics, 5th Edition (pp.xx-xxi)
- Fundamentals of Mechanical and Electrical Mathematics
- NWT Apprenticeship Support Materials Module 1 (Foundations)

Contextualized Resources:

- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07

Online Resources:

- <http://www.shodor.org/unchem/math/calc/index.html>
- <http://www.how2begin.com/business/how-to-use-a-scientific-calculator-3.html>
- <http://www.uccs.edu/~energy/courses/calculator.html>
- <http://www.khake.com/page47.html>

PM2 Use Positive and Negative Numbers

Upon completion of this objective, learners will be able to:

- 2.1 read positive and negative numbers
- 2.2 write positive and negative numbers
- 2.3 round positive and negative numbers
- 2.4 estimate positive and negative numbers
- 2.5 order positive and negative numbers
- 2.6 compare positive and negative numbers
- 2.7 add positive and negative numbers
- 2.8 subtract positive and negative numbers
- 2.9 multiply positive and negative numbers
- 2.10 divide positive and negative numbers
- 2.11 use knowledge of positive and negative numbers to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Measurement and Calculation for the Trades
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- Practical Problems in Mathematics for Heating and Cooling Technicians
- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill # 1 and 2)
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*

Online Resources:

- <http://www.math.com/school/subject1/lessons/S1U1L11DP.html>
- <http://www.mathleague.com/help/integers/integers.htm#subtractingintegers>
- <http://www.math.com/school/subject1/lessons/S1U1L12DP.html>
- <http://www.mathleague.com/help/integers/integers.htm#dividingintegers>
- <http://www.khake.com/page47.html>
- <http://www.kutasoftware.com/free.html>
- <http://www.math-drills.com/orderofoperations.shtml>
- <http://www.mathleague.com/help/integers/integers.htm#multiplyingintegers>

PM3 Use Order of Operations

Upon completion of this objective, learners will be able to:

- 3.1 identify the necessary steps in performing order of operations
- 3.2 calculate answers using correct order of operations
- 3.3 use order of operations to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 1 (Foundations)

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #3)
- HVAC Level 1-Trade Mathematics Module 030102-07

Online Resources:

- <http://www.tpub.com/math2/index.htm>
- <http://www.khake.com/page47.html>
- <http://www.kutasoftware.com/free.html>
- <http://www.purplemath.com/modules/orderops.htm>
- <http://www.math-drills.com/orderofoperations.shtml>
- http://amby.com/educate/ord-op/ex_set-1.html

PM4 Use Fractions

Upon completion of this objective, learners will be able to:

- 4.1 read fractions
- 4.2 write fractions
- 4.3 compare fractions
- 4.4 round fractions
- 4.5 simplify fractions
- 4.6 add fractions
- 4.7 subtract fractions
- 4.8 multiply fractions
- 4.9 divide fractions
- 4.10 use knowledge of fractions to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition*
- Math to Build On-A Book for Those Who Build
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #4)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*
- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.tpub.com/math2/index.htm>
- <http://www.khake.com/page47.html>
- <http://www.math-drills.com/fractions.shtml>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM5 Use Mixed Numbers

Upon completion of this objective, learners will be able to:

- 5.1 read mixed numbers
- 5.2 write mixed numbers
- 5.3 compare mixed numbers
- 5.4 round mixed numbers
- 5.5 simplify mixed numbers
- 5.6 add mixed numbers
- 5.7 subtract mixed numbers
- 5.8 multiply mixed numbers
- 5.9 divide mixed numbers
- 5.10 use knowledge of mixed numbers to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition*
- Math to Build On-A Book for Those Who Build
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill # 4)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*
- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page47.html>
- <http://www.math-drills.com/fractions.shtml>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM6 Use Decimals

Upon completion of this objective, learners will be able to:

- 6.1 read decimals
- 6.2 write decimals
- 6.3 estimate decimals
- 6.4 round decimals
- 6.5 add decimals
- 6.6 subtract decimals
- 6.7 multiply decimals
- 6.8 divide decimals
- 6.9 use knowledge of decimals to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Math to Build On-A Book for Those Who Build
- Mathematics for Carpentry and the Construction Trades
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #5)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*
- Residential Oil Burners, *3rd Edition*

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page47.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM7 Use Percent

Upon completion of this objective, learners will be able to:

- 7.1 use formulae to calculate percent
- 7.2 use knowledge of percent to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Mathematics for Carpentry and the Construction Trades
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #6)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- Mastering Math for the Building Trades

Technical Resources:

- HVACR 101

Online Resources:

- <http://www.khake.com/page47.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM8 Use Conversion

Upon completion of this objective, learners will be able to:

- 8.1 explain the purpose of mathematical conversion
- 8.2 convert among fractions, decimals and percents
- 8.3 use automatic recall of decimal and percent equivalents of common fraction
- 8.4 use knowledge of conversion to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Mathematics for Carpentry and the Construction Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #7)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades

Online Resources:

- <http://www.khake.com/page47.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM9 Use Measurement Systems

Upon completion of this objective, learners will be able to:

- 9.1 demonstrate uses of specific measurements
- 9.2 perform conversions within the metric measurement system
- 9.3 perform conversions within the imperial measurement system
- 9.4 perform conversions between the metric and imperial measurement systems
- 9.5 perform time conversions
- 9.6 use knowledge of measurement and time conversion to solve problems

Note: Special attention should be given to temperature conversion.

Non-contextualized Resources:

- Introductory Technical Mathematics, 5th Edition
- Math to Build On-A Book for Those Who Build
- Mathematics for Carpentry and the Construction Trades
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #9, 10, and 11)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, 3rd Edition

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, 18th Edition

Online Resources:

- <http://www.khake.com/page47.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM10 Use Rate, Ratio and Proportion

Upon completion of this objective, learners will be able to:

- 10.1 describe the differences among rate, ratio and proportion
- 10.2 give examples of how rate, ratio and proportion are used in the trade
- 10.3 write numbers as proportions
- 10.4 use knowledge of rate to solve problems
- 10.5 use knowledge of ratio to solve problems
- 10.6 use knowledge of proportion to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition*
- Mathematics for Carpentry and the Construction Trades
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #8)
- Practical Problems in Mathematics for Heating and Cooling Technicians

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*

Online Resources:

- <http://www.khake.com/page47.html>
- <http://www.mathleague.com/help/ratio/ratio.htm#ratio>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM11 Use Square Root and Exponents

Upon completion of this objective, learners will be able to:

- 11.1 determine the square root of positive numbers that are perfect squares
- 11.2 determine approximate square root of positive numbers that are not perfect squares
- 11.3 use knowledge of square root to solve problems
- 11.4 use knowledge of exponent laws to solve problems
- 11.5 determine significant digits
- 11.6 use knowledge of scientific notation to solve problems

Non-contextualized Resources:

- Math to Build On-A Book for Those Who Build
- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #12, 14, 15, & 16)
- HVAC Level 1-Trade Mathematics Module 030102-07

Technical Resources:

- HVACR 101
- Modern Refrigeration and Air Conditioning, *18th Edition*

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page47.html>
- <http://www.kutasoftware.com/free.html>

PM12 Solve Equations

Upon completion of this objective, learners will be able to:

- 12.1 write variable expressions and equations from sentences
- 12.2 simplify variable expressions
- 12.3 write equations from sentences
- 12.4 solve one-step equations
- 12.5 solve two-step equations
- 12.6 solve multi-step equations

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (Units 14-18)
- NWT Apprenticeship Support Materials Module 3 (Variables and Equations)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #13)
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*

Online Resources:

- <http://www.khake.com/page47.html>
- <http://www.kutasoftware.com/free.html>

PM13 Use Trade-Related Formulae

Upon completion of this objective, learners will be able to:

- 13.1 identify formulae common to the trade
- 13.2 solve problems using formulae as written
- 13.3 solve problems by rearranging formulae

General Resources:

- HVACR 101
- Practical Problems in Mathematics for Heating and Cooling Technicians
- Modern Refrigeration and Air Conditioning, *18th Edition*
- Residential Oil Burners, *3rd Edition*

Perimeter, Area, Circumference

Non-Contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)
- Formulas at Work (SkillPlan)
- Measurement and Calculation for the Trades
- Math to Build On-A Book for Those Who Build

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #19 and 20)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*

Volume and Surface Area**Non-contextualized Resources:**

- Introductory Technical Mathematics, *5th Edition*
- Math to Build On-A Book for Those Who Build
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)
- Mathematics for Carpentry and the Construction Trades
- Formulas at Work (SkillPlan)
- Measurement and Calculation for the Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #20)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*

Pythagorean Theorem

Learners should be able to apply the Pythagorean Theorem to determine whether or not a triangle is a right triangle, to determine the measure of the third side of a right triangle when the measures are given for the two other sides, and to determine the distance between two points on a coordinate plane.

Non-contextualized Resources:

- Math to Build On-A Book for Those Who Build
- Introductory Technical Mathematics, *5th Edition*
- Mathematics for Carpentry and the Construction Trades
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)
- Formulas at Work (SkillPlan)
- Measurement and Calculation for the Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #18)
- HVAC Level 1-Trade Mathematics Module 030102-07
- Mastering Math for the Building Trades

Online Resources:

- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>
- <http://www.swtc.edu:8082/mscenter/tutorial.htm#Formulas>

PM14 Use Estimation

Upon completion of this objective, learners will be able to:

- 14.1 identify estimation rules
- 14.2 use estimation rules to solve single-step problems
- 14.3 use estimation rules to solve multi-step problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition* (Unit 7)
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill #17)

PM15 Use Angles

Upon completion of this objective, learners will be able to:

- 15.1 identify various types of angles common to the trade
- 15.2 compare angles common to the trade
- 15.3 measure angles
- 15.4 use knowledge of angles to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #17)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- Modern Refrigeration and Air Conditioning, 18th Edition

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page47.html>
- <http://www.math-drills.com/orderofoperations.shtml>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM16 Use Geometric Shapes

Upon completion of this objective, learners will be able to:

- 16.1 identify geometric shapes
- 16.2 use knowledge of geometric shapes to solve problems

Learners should identify and name the various types of triangles and understand the concept of similar triangles.

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill #18, 19, and 20)
- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07
- Blueprints and Plans for HVAC, *3rd Edition*

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*

Online Resources:

- <http://www.tpub.com/math2/index.htm>
- <http://www.khake.com/page89.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM17 Use Trigonometry

Upon completion of this objective, learners will be able to:

- 17.1 identify the value of trigonometry in the trade
- 17.2 set up trigonometric ratios
- 17.3 use trigonometric functions to solve problems

Non-contextualized Resources:

- Math to Build On-A Book for Those Who Build
- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)
- Measurement and Calculation for the Trades

Contextualized Resources:

- Practical Problems in Mathematics for Heating and Cooling Technicians
- HVAC Level 1-Trade Mathematics Module 030102-07

Online Resources:

- <http://www.jimdesu.us/pages/trigonometry.html>
- <http://www.swtc.edu:8082/mscenter/tutorial.htm#Introduction%20to%20Trigonometry>
- <http://www.tpub.com/math2/index.htm>
- <http://www.onlinemathlearning.com/basic-trigonometry.html>
- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- http://www.funmaths.com/worksheets/math_trigonometry_05.htm
- <http://www.xpmath.com/exercises/files/sincos.pdf>
- <http://www.xpmath.com/exercises/files/tan.pdf>

PM18 Analyze Numerical Data

Upon completion of this objective, learners will be able to:

- 18.1 identify ways to organize data
- 18.2 organize information into charts and graphs
- 18.3 extract information from charts and graphs
- 18.4 evaluate information found in charts and graphs
- 18.5 make predictions and draw conclusions

Non-contextualized Resources

- Workplace Communications-The Basics, *3rd Edition* (Chapter 3)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- Practical Problems in Mathematics for Heating and Cooling Technicians
- EARAT (Mathematics for Refrigeration and Air Conditioning Apprentices: Skill #21)

Technical Resources:

- Modern Refrigeration and Air Conditioning, *18th Edition*

Online Resources

- <http://wise.cgu.edu/tutor.asp>

Appendix A

Resource Materials:

Blueprints and Plans for HVAC, 3rd Edition

Frank Miller, Wilma Miller, and Joseph Moravek
Delmar Cengage Learning, 2008
ISBN: 13-978-1-4283-3520-2

Evaluating Academic Readiness for Apprenticeship Training (EARAT)

Mathematics for Refrigeration and Air Conditioning Apprentices
Workplace Support Services Branch
Ontario Ministry of Training, Colleges and Universities, October 2000
Tel: 416-325-2929 or 1-800-387-5514
Email: info@edu.gov.on.ca

Formulas at Work: Tradesworkers on the Job

Sue Grecki
SkillPlan: BC Construction Industry Skills Improvement Council, 2007
ISBN: 978-0-9739232-6-1
www.skillplan.ca

Fundamental Mathematics, 4th Edition

Marvin L. Bittinger
Pearson Education, Inc., 2007
ISBN: 0-321-31907-9

Fundamentals of Mechanical and Electrical Mathematics

National Centre for Construction Education and Research
Prentice Hall, Inc., 1996
ISBN: 0-13-910142-X

HVACR101

Air Conditioning Contractors of America
Plumbing-Heating-Cooling-Contractors
National Association Educational Foundation
Refrigeration Service Engineers Society
ISBN: 13-978-1-4180-6663-5

Introductory Technical Mathematics, 5th Edition

Robert Smith and John C. Peterson

Thomson, Delmar Learning, 2007

ISBN: 1-4180-1543-1

www.delmarlearning.com

Mastering Math for the Building Trades

James Gerhart

McGraw-Hill, 2000

ISBN: 0-07-136023-9

Math to Build On - A Book for Those Who Build

Johnny and Margaret Hamilton

Construction Trades Press, 1993

ISBN: 0-9624197-1-0

www.pipefitter.com

Mathematics for Carpentry and the Construction Trades, 2nd Edition

Alfred Webster and Kathryn B. Judy

Pearson Education, Inc., 2002

ISBN: 0-13-163305-8

Measurement and Calculation for the Trades

Sue Grecki and Bob Whitaker

SkillPlan: BC Construction Industry Skills Improvement Council, 2006

ISBN: 0-9685027-9-2

www.skillplan.ca

Modern Refrigeration and Air Conditioning, 18th Edition

Andrew D. Althouse, Carl H. Turnquist, Alfred F. Bracciano

The Goodheart-Willcox Company, Inc.,

ISBN: 13-978-1-59070-280-2

ISBN (Instructor's Manual): 13-978-1-59070-283-3

ISBN (Study Guide): 13-978-1-59070-281-9

ISBN (Laboratory Manual): 13-978-1-59070-282-6

NWT Apprenticeship Support Materials

Thomas O'Connor

Genesis Group Ltd., Yellowknife, NWT, 2003

Practical Problems in Mathematics for Heating and Cooling Technicians, 5th Edition

Russel De Vore

Delmar, Cengage Learning, 2009

ISBN: 13-978-1-4483-2428-2

Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Jack Martin and Mary Serich

Jack Martin and Associates, 2006

ISBN: 0-9649530-1-3

Residential Oil Burners, 3rd Edition

Herb Weinberger

Thomson Delmar Learning, 2008

ISBN: 13-978-1-4180-7397-8

ISBN (Instructor's Guide): 13-978-1-4180-7398-5

Trade Mathematics Module 030102-07

HVAC Level 1-Trainee Guide

Contren Learning Series

National Center for Construction Education and Research, 2007

Workplace Communications-The Basics, 3rd Edition

George J. Searles

Pearson Education, Inc., 2006

ISBN: 0-321-33068-4

All online resources listed in this document were operational at time of publication.

Oral Communication (OC) Learning Outcome: Learners will perform tasks which use speech to give and exchange thoughts and information.

OC1 Demonstrate an Understanding of Oral Communication	1.1 Differentiate between oral and other forms of communication	1.2 Identify purpose of oral communication	1.3 Identify the benefits of effective oral communication	1.4 Identify barriers to effective oral communication	1.5 Identify the risks associated with ineffective oral communication	1.6 Outline ways to reduce the risk of ineffective communication
OC2 Communicate Effective Messages	2.1 Identify audience	2.2 Identify the purpose of communicating effective messages	2.3 Organize thoughts and ideas	2.4 Communicate effectively to a variety of audiences		
OC3 Listen Effectively	3.1 Identify the difference between listening and active listening	3.2 Identify the purpose of effective listening	3.3 Identify active listening strategies	3.4 Implement active listening strategies		
OC4 Respond to Oral Communication	4.1 Identify the main idea	4.2 Interpret verbal messages	4.3 Clarify received verbal messages	4.4 Respond appropriately to verbal messages		

Learners will perform tasks which use speech to give and exchange thoughts and information

Introduction

Success in technical training and effective job performance requires strong Essential Skills. Although all Essential Skills contribute to success, this guide is intended to help apprentices develop positive oral communication (OC) for their trade. Competence in oral communication provides the foundation for better performance in technical training, on the job and when mentoring new apprentices.

Strong oral communication skills are required in every occupation. In fact, many surveys indicate that it is one of the most highly valued skills among employers as it is intimately tied to everyday workplace functions. Oral Communication in trade occupations is usually presented face-to-face, by telephone, or by two-way radio with a number of factors affecting the transfer of the message.

The following guide is an introduction to the basic principles and methods of oral communication with an emphasis on the importance of speaking, listening, and interacting in the context of customer service and interpersonal communication.

A list of resources (see Appendix A) has been outlined for each objective in the Oral Communication Curriculum Framework and, where possible, includes online website materials that complement these resources. All information is presented in a generic manner; the contextualization to specific trades will be found in the expected tasks of each trade, determined by the instructor.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose materials and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Oral Communication in Trades Occupations

To make the most of technical training, apprentices need to develop strategies for effective listening, as well as the confidence and speaking skills to ask for help. These same strategies are used in the workplace to interact with co-workers, supervisors, workers in other trades, suppliers and customers. Understanding the many elements in the communications process helps apprentices send clear messages and understand the messages received.

Trades people communicate orally on a daily basis to complete job tasks. The complexity of these tasks, according to Human Resources and Skills Development Canada's Essential Skills Profiles (<http://srv108.services.gc.ca/>), varies slightly among the thirteen trades outlined in the Trade Essentials project (see Curriculum Guidebook), though all thirteen trades describe the least complex oral communication tasks as those containing some or all of the following characteristics:

- Limited oral communication demands;
- Narrow range of subject matter;
- Familiar topic;
- One main issue;
- Factual, literal, or concrete language;
- Narrow range of content and context-specific or technical vocabulary;
- Clearly defined role of speaker;
- Interaction with one person at a time;
- Low risk;
- Brief exchange (less than ten minutes)

The most complex tasks performed by cooks, welders, carpenters, automotive service technicians, steamfitters/pipefitters, cabinetmakers, machinists, industrial and construction electricians and metal fabricators contain some or all the following characteristics:

- Extensive oral communication demands;
- Significant range of subject matter;
- Professional, organizational, theoretical social issues;
- Abstract and conceptual language;
- Extensive range of technical vocabulary and idiom;
- Complex and detailed information content;
- Unpredictable context;
- Various communication venues used;
- Significant range of formats and styles;
- Communicator may have more than one role;
- New and unfamiliar situation and setting;
- Medium to extended (30+ minutes) exchange;
- Significant noise or interference;
- Significant level of risk

The most complex oral communication tasks performed by plumbers, oil burner mechanics and refrigeration and air conditioning mechanics contain some or all of the following characteristics:

- Moderate oral communication demands;
- Narrow range of subject matter;
- Familiar topic;
- Usually one main issue;
- Factual or concrete and abstract language;
- Moderate range of general and context-specific or technical vocabulary and idiom;
- Moderately complex and detailed content;
- Less predictable context;
- Interaction is frequently one-on-one or with several people;
- Give directions to a small group;
- Select from a moderate range of formats and styles;
- Established rules;
- Brief to moderate (10-30 minutes) exchange;
- Physical conditions may impede communication;
- Moderate level of risk;
- May be one-on-one hostility

Upon completion of this course, apprentices will better understand how communication skills impact safety, productivity, job satisfaction and job progression. Effective communication skills will benefit apprentices as they reach journey person status and as they accept additional responsibility for supervising and mentoring new employees.

For specific information and examples of the use of oral communication for each trade, instructors should refer to the Essential Skills Profile and the National Occupational Analysis. It should be noted that, according to HRSDC's Essential Skills profiles, oral communication is one of the most important Essential Skills for cooks, plumbers and automotive service technicians as these tradespeople interact frequently with customers.

Note: It is intended that the oral communication curriculum be embedded in other Essential Skills curriculum where possible. Many of the competencies in oral communication and the five other essential skills may be mastered concurrently.

General Online Resources:***Essential Skills Profile and Readers Guide***

Human Resources and Skills Development Canada

http://srv108.services.gc.ca/english/general/home_e.shtml***National Occupational Analysis***http://www.red-seal.ca/Site/trades/analist_e.htm**Trade Specific Resources:**<http://www.ific.org/tools/> (International Food Information)

OC1 Demonstrate an Understanding of Oral Communication

Upon completion of this objective, learners will be able to:

- 1.1 differentiate between oral and other forms of communication
 - distinguish between verbal and non-verbal communication
- 1.2 identify the purpose of oral communication
- 1.3 identify the benefits of effective oral communication
 - project a professional image through oral communication
- 1.4 identify barriers to effective oral communication
 - identify how the following can produce barriers: sender, listener, content, environment
 - outline personal habits that may interfere with effective oral communication: tone, volume, voice speed, facial expression, eye contact, etc.
- 1.5 identify the risks associated with ineffective oral communication
- 1.6 outline ways to reduce the risk of ineffective oral communication

Suggested Strategies and Activities:

- Hold a general discussion on benefits of effective oral communication
- Ask learners for examples of workplace communication, both effective and ineffective, and the consequences of each
- Refer to Essential Skills profile for the trade and find examples of the various types of communication and the purpose
- Discuss the factors that determine whether the communication is either simple or complex
- Explain the elements of communication
- Discuss the difference between, and the importance of, both verbal and non-verbal communication
- Discuss specific, common barriers as they relate to the trade
- Provide learners with an opportunity to assess areas of strength and those areas where they should improve
- Establish some rules for effective communication in class
- Have learners reflect upon communicative challenges in everyday life

Resources:

- Applied Communication Skills for the Construction Trades
- Tools for Success: *Soft Skills for the Construction Industry*
- Business English and Communication, *5th Canadian Edition*
- Effective Workplace Communication, *3rd Edition*
- Communicating in the Workplace, *6th Canadian Edition*
- HVACR 101 (Chapter 10)

Online Resources:

- <https://www.lseducation.org.uk/user/order.aspx?code=060014> (Teaching speaking and listening; a toolkit for practitioners)
- <http://www.mindtools.com/page8.html> (Mind Tools: Communication Skills)
- <http://www.khake.com/page66.html>
- <https://www.lseducation.org.uk/user/login.aspx?code=078838&P=078838PD&action=pdfdl&src=XOWEB> (Key Skills Support Program: Communication)

OC2 Communicate Effective Messages

Upon completion of this objective, learners will be able to:

- 2.1 identify audience
- 2.2 identify purpose
- 2.3 organize thoughts and ideas
- 2.4 communicate effectively to a variety of audiences
 - use non-verbal techniques to reinforce the verbal message
 - use appropriate terminology
 - communicate one-on-one
 - participate in group discussions
 - present information to groups

Suggested Strategies and Activities:

- Ask learners to identify the different people they speak with at work (i.e., project managers, supervisors, foremen, co-workers, workers in other trades, customers, suppliers)
- Discuss the differences in communicating with each
- Ask learners to think about the jargon, technical language and abbreviations that are used in their trade and the appropriateness of using this language with each audience
- Increase awareness of poor speech habits by creating a list of those that learners have observed
- Identify and discuss significance of non-verbal communication such as facial expression, posture and gestures
- Identify strategies for effective telephone communication, use of cellular telephone and two-way radio
- Provide opportunities for learners to give instructions in class setting by giving oral instructions to others one-on-one or to the group
- Provide opportunities for engaging learners in discussion
- Encourage speaking in class to increase learner confidence
- Hand out materials on effective participation in meetings/group discussions
- Provide opportunities for learners to share information in the form of a short presentation on a topic that they are comfortable with using a visual aid such as a picture, sketch, diagram to increase understanding
- Use the process of giving and receiving of feedback as a communication situation
- Create a safe atmosphere for giving and receiving feedback on communication style

- Assign learners the task of leading the class through some of the assigned material

Resources:

- Tools for Success: *Soft Skills for the Construction Industry*
- Applied Communications Skills for the Construction Trades
- Business English and Communication, *5th Canadian Edition*
- Communicating in the Workplace, *6th Canadian Edition*
- HVACR 101 (Chapter 10)
- Effective Workplace Communication, *3rd Edition*

Online Resources:

- <https://www.lseducation.org.uk/user/order.aspx?code=060014> (Teaching speaking and listening; a toolkit for practitioners)
- <https://www.lseducation.org.uk/user/login.aspx?code=078838&P=078838PD&action=pdfdl&src=XOWEB> (Key Skills Support Program: Communication)
- <http://www.mindtools.com/page8.html> (Mind Tools: Communication Skills)
- <http://www.khake.com/page66.html>

OC3 Listen Effectively

Upon completion of this objective, learners will be able to:

- 3.1 identify the difference between listening and active listening
- 3.2 identify the purpose of active listening
- 3.3 identify active listening strategies
- 3.4 implement active listening strategies

Suggested Strategies and Activities:

- Discuss the importance of good listening skills in a variety of situations at work
- Define active listening
- Identify barriers to effective listening
- Have learners think about and monitor their listening skills
- Identify strategies for active listening including paraphrasing, questioning and note-taking
- Practice strategies for active listening
- Encourage learners to implement active listening strategies during training and on the job
- Have learners receive and follow-up on messages and instruction

Resources:

- Effective Workplace Communication, *3rd Edition*
- Tools for Success: *Soft Skills for the Construction Industry*
- Applied Communications Skills for the Construction Trades
- Business English and Communication, *5th Canadian Edition*
- Communicating in the Workplace, *6th Canadian Edition*
- HVACR 101 (Chapter 10)

Online Resources:

- <https://www.lseducation.org.uk/user/order.aspx?code=060014> (Teaching speaking and listening; a toolkit for practitioners)
- <https://www.lseducation.org.uk/user/login.aspx?code=078838&P=078838PD&action=pdfdl&src=XOWEB> (Key Skills Support Program: Communication)
- <http://www.mindtools.com/page8.html> (Mind Tools: Communication Skills)
- <http://www.khake.com/page66.html>
- http://www.cte.uwaterloo.ca/teaching_resources/teaching_tips/tips_challenges/effective_communication.pdf (Teaching Tips)

OC4 Respond to Oral Communication

Upon completion of this objective, learners will be able to:

- 4.1 identify the main idea
- 4.2 interpret verbal messages
 - differentiate among fact, opinion and feeling
 - distinguish between relevant and irrelevant information
 - identify the role of non-verbal messages in oral communication
- 4.3 clarify received messages
 - ask questions to understand
 - summarize and restate information
- 4.4 respond appropriately to verbal messages

Suggested Strategies and Activities:

- Discuss the role of intonation, posture, gestures, tone of voice, facial expression, and eye movement
- Have learners recognize and interpret visual cues (i.e., gestures, facial expression) to help understand messages
- Discuss 'vocally produced noises' (i.e., ah)
- Have learners brainstorm common 'vocally produced noises'
- Discuss how emotion can impact oral communication
- Have learners listen and respond to the viewpoints of others by asking relevant questions, offering opinions, and/or interpretations
- Use suitable resources for discussion (i.e., newspaper or magazine article on trade related material)
- Have learners judge what information is relevant in verbal messages and trade-related material

Resources:

- Applied Communication Skills for the Construction Trades
- Tools for Success: *Soft Skills for the Construction Industry*
- Effective Workplace Communication, 3rd Edition
- Business English and Communication, 5th Canadian Edition
- Communicating in the Workplace, 6th Canadian Edition

Online Resources:

- <http://www.khake.com/page66.html>

Appendix A

Resources:

Applied Communications Skills for the Construction Trades

Stephan A. Rigolosi
Pearson Education Inc. 2002
ISBN 0-13-093355-4

Business English and Communication, 5th Canadian Edition

Lyn R. Clark et al
McGraw-Hill Ryerson Limited, 1996
ISBN: 0-07-551777-9 (Teacher's Edition)

Communicating in the Workplace, 6th Canadian Edition

Margaret Dombeck et al
McGraw-Hill Ryerson Limited, 2003
ISBN: 978-0-07090-814-7

Effective Workplace Communications-Skills for Success in Life and on the Job, 3rd Edition

Marsha Ludden
JIST Works, 2007
ISBN: 978-1-59357-433-8
www.jist.com

HVACR 101

Air Conditioning Contractors of America
PHCC Educational Foundation
Refrigeration Service Engineers Society
Delmar CENGAGE Learning, 2009
ISBN: 13-978-1-4180-663-5

Tools for Success- Soft Skills for the Construction Industry, 2nd Edition

National Centre for Construction Education and Research
Pearson Education, Inc., 2004
ISBN: 0-13-109194-8

All online resources listed in this document were operational at time of publication.

Computer Use (CU) Learning Outcome: Learners will use computer technology to access and interpret information and to communicate.

**CU1 Use
Computer
Operations**

1.1 Identify the primary components of a computer	1.2 Describe the function of the primary components of a computer	1.3 Start up the computer, monitor, and printer	1.4 Shut down the computer, monitor, and printer	1.5 Log onto a network using a personal password	1.6 Demonstrate basic trouble-shooting strategies
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**CU2 Use Word
Processing Skills**

2.1 Open and close software	2.2 Create written documents	2.3 Create tables, graphs, and charts	2.4 Open existing written documents, tables, graphs, and charts	2.5 Save written documents, tables, graphs, and charts	2.6 Preview and print written documents, tables, graphs, and charts
2.7 Copy and move text	2.8 Delete text	2.9 Format text	2.10 Set tabs	2.11 Set margins	2.12 Add and delete headers and footers
2.13 Add and delete page numbers	2.14 Set page layout	2.15 Check and correct spelling	2.16 Check and correct grammar	2.17 Use thesaurus	

**CU3 Use File
Management
Skills**

3.1 Distinguish between files and folders	3.2 Create files and folders	3.3 Save files	3.4 Copy files and folders	3.5 Move files and folders	3.6 Organize files and folders
3.7 Rename files and folders	3.8 Delete files and folders				

**CU4 Use
Spreadsheets**

4.1 Identify the purpose of spreadsheets in the trade	4.2 Interpret information in existing spreadsheets	4.3 Enter data into existing spreadsheets	4.4 Manipulate data within existing spreadsheets	4.5 Create spreadsheets	4.6 Create and copy formulas to perform calculations
4.7 Print spreadsheets	4.8 Print selected parts of spreadsheets				

**CU5 Read and
Write Email
Messages**

5.1 Open messages	5.2 Reply to messages	5.3 Write, send, and forward messages	5.4 Print messages	5.5 Add attachments to messages	5.6 Delete messages
5.7 Create folders	5.8 Move messages to folders	5.9 Delete folders	5.10 Identify and manage common email problems		

**CU6 Use Web
Search Skills**

6.1 Define web browser	6.2 Access a specific website	6.3 Use a search engine	6.4 Evaluate information found on the World Wide Web	6.5 Download information from the World Wide Web	6.6 Copy information from the World Wide Web
6.7 Save information from the World Wide Web	6.8 Share information from the World Wide Web	6.9 Print information from the World Wide Web			

Learners will use computer technology to access and interpret information and to communicate

Introduction

The workforce is constantly changing. Today's employees are highly mobile, expect continuous learning to be an integral part of their job and are adapting to a technological world. In fact, technology has changed the very fabric of the workplace and, as a result, workers are expected to acquire a broad range of skills if they are to remain current, accurate and competitive. Trades occupations are no exception. For example: automation in plants and factories has demanded an increased knowledge of networking and software use; lathes and cutting tools are often linked to computers; and entrepreneurs require skills in word processing, accounting, email and internet use, and database management.

This Computer Use (CU) course has been designed to help workers adapt to this ever-changing society. It is intended for individuals who are inexperienced computer users but who want to gain some hands-on skill and confidence. It assumes no previous knowledge of computers and will provide learners with a broad overview of computer and Internet technology. The following major topic areas are explored:

- Computer Operations
- Word Processing
- File Management
- Spreadsheets
- Email
- Web Browsing
- Safe Use of Computers

This following guide outlines a list of recommended resources (See Appendix A) for each objective in the Computer Use curriculum framework and, where possible, includes online website materials that complement these resources. Because computer skills are generic in the workplace, this course is not contextualized to specific trades. Apprentices, however, should be provided with examples of how computers are used in their respective trade. Contextualized website lists are provided in Appendix B.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Note: *The computer use curriculum can be used in one of two ways: as a stand-alone course or embedded in other Essential Skills curriculum. For instance, computer use competencies (i.e., email, word processing) and writing competencies may be mastered concurrently.*

CU1 Use Computer Operations

Upon completion of this objective, learners will be able to

- 1.1 identify the primary components of a computer – monitor, keyboard, mouse, system unit, ports, disk drives, printers
- 1.2 describe the function of the primary components of a computer
- 1.3 start up the computer, monitor and printer
- 1.4 shut down the computer, monitor and printer
- 1.5 log onto a network using a personal password
- 1.6 demonstrate basic troubleshooting strategies
 - protect and care for flash drives, CD-ROMs and other media
 - clean computer components
 - maintain back-up copies of documents
 - perform basic maintenance

Resources:

- Essential Skills for Digital Literacy- IC3 Module A ~ Courseware 2105-2 - Computing Fundamentals using Windows XP

Online Resources:

- www.ctdlc.org/remediation/indexComputer.html
- www.homepages.ed.ac.uk/calarks/arks/materials.html
- www.functionx.com/windows/Lesson01.htm
- www.bcot1.com/

CU2 Use Word Processing Skills

Upon completion of this objective, learners will be able to:

- 2.1 open and close software
- 2.2 create written documents
- 2.3 create tables, graphs, and charts
- 2.4 open existing written documents, tables, graphs and charts
- 2.5 save written documents, tables, graphs and charts
- 2.6 preview and print written documents, tables, graphs and charts
- 2.7 copy and move text
- 2.8 delete text
- 2.9 format text
 - change font
 - highlight text
 - italicize, bold, and underline text
- 2.10 set tabs
- 2.11 set margins
- 2.12 add and delete headers and footers
- 2.13 add and delete page numbers
- 2.14 set page layout
- 2.15 check and correct spelling
- 2.16 check and correct grammar
- 2.17 use thesaurus

Resources:

- Essential Skills for Digital Literacy IC3 Module B ~ Courseware 2109-2 - Key Applications using Microsoft Office 2003

Online Resources:

- <http://www.baycongroup.com/wlesson0.htm>
- www.ctdlc.org/remediation/indexWord.html
- www.shaunakelly.com/word/concepts/starttyping/index.html
- www.baycongroup.com/tutorials.htm
- www.itrainonline.org/itrainonline/english/computers.shtml
- www.homepages.ed.ac.uk/calarks/arks/materials.html
- <http://www.hilc.ns.ca/downloads/pdfs/resources/ESLComputerBookWord2000.pdf>
- www.nald.ca/library/learning/WPerfect/WP8.pdf
- www.bcot1.com/

CU3 Use File Management Skills

Upon completion of this objective, learners will be able to:

- 3.1 distinguish between files and folders
- 3.2 create files and folders
- 3.3 save files
- 3.4 copy files and folders
- 3.5 move files and folders
- 3.6 organize files and folders
- 3.7 rename files and folders
- 3.8 delete files and folders

Resources:

- Essential Skills for Digital Literacy- IC3 Module A ~ Courseware 2105-2 - Computing Fundamentals Using Windows XP

Online Resources:

- www.onlinecomputertips.com/tutorials/file_mgmt.html
- www.inet4.swtjc.net/nmasters/Orientation/Topic05.htm
- www.cter.ed.uiuc.edu/tutorials/filemanagmt/
- www.facweb.furman.edu/~pecoy/mfl195/tutorial/index.htm
- www.bcot1.com/

CU4 Use Spreadsheets

Upon completion of this objective, learners will be able to:

- 4.1 identify the purpose of spreadsheets in the trade
- 4.2 interpret information in existing spreadsheets
- 4.3 enter data into existing spreadsheets
- 4.4 manipulate data within an existing spreadsheet
- 4.5 create a spreadsheet
- 4.6 create and copy formulas to perform calculations
- 4.7 print spreadsheets
- 4.8 print selected parts of spreadsheets

Resources:

- Essential Skills for Digital Literacy- IC3 Module B ~ Courseware 2109-2 - Key Applications Using Microsoft Office 2003

Online Resources:

- <http://www.baycongroup.com/el0.htm>
- www.homepages.ed.ac.uk/calarks/arks/Materials/it2001/Database_2001.pdf
- <http://www.swtc.edu:8082/mscenter/tutorial.htm#Editing%20in%20Excel>
- www.nald.ca/CLR/Excel2k2/Excel2k2.pdf
- <http://www.wcu.edu/199.asp>
- www.bcot1.com/

CU5 Read and Write Email Messages

Upon completion of this objective, learners will be able to:

- 5.1 open messages
- 5.2 reply to messages
- 5.3 write, send, and forward messages
- 5.4 print messages
- 5.5 add attachments to messages
- 5.6 delete messages
- 5.7 create folders
- 5.8 move messages to folders
- 5.9 delete folders
- 5.10 identify and manage common email problems

Resources:

- Essential Skills for Digital Literacy- IC3 Module C ~ Courseware 2118-2 - Living Online Using Windows XP
- Tools for Success Soft Skills for the construction Industry, *2nd Edition*, Module 6
- Effective Workplace Communications-Skills for Success in Life and on the Job, *3rd Edition* (Chapter 7)

Online Resources:

- www.ctdlc.org/remediation/indexe-mail.html (tutorial)
- <http://www.scs.nevada.edu/support/tutorials/nettutor/>
- www.colc.co.uk/new/index.html (tutorial)
- www.homepages.ed.ac.uk/calarks/arks/Materials/it2001/e-mail.pdf
- www.misa.ns.ca/downloads/pdfs/resources/newESLComputerBookTheInternet.pdf
- www.bcot1.com/

CU6 Use Web Search Skills

Upon completion of this objective, learners will be able to:

- 6.1 define web browser
- 6.2 access a specific website
- 6.3 use a search engine
- 6.4 evaluate information found on the World Wide Web
- 6.5 download information from the World Wide Web
- 6.6 copy information from the World Wide Web
- 6.7 save information from the World Wide Web
- 6.8 share information from the World Wide Web
- 6.9 print information from the World Wide Web

Resources:

- Essential Skills for Digital Literacy- IC3 Module C ~ Courseware 1103-1 - Living Online Using Windows XP
- Applied Communication Skills for the Construction Trades (Module 6)

Online Resources:

- www.ctdlc.org/remediation/indexWeb.html (tutorial)
- www.scs.nevada.edu/support/tutorials/
- www.colc.co.uk/new/index.html (tutorial)
- www.homepages.ed.ac.uk/calarks/arks/Materials/it2001/internet_explorer.pdf
- www.nald.ca/CLR/Internet/internet.pdf
- www.bcot1.com/
- http://www.newbie.org/internet_explorer/

General Search Engines:

- www.a9.com (Powered by Amazon)
- www.google.ca/ (Google Canada)
- www.live.com/ (MSN Search)
- ca.yahoo.com/?p=us (Yahoo)
- en-us.start.mozilla.com (Firefox)

Appendix A

Resources:

Effective Workplace Communications-Skills for Success in Life and on the Job, 3rd Edition

Marsha Ludden

JIST Works, 2007

ISBN: 978-1-59357-433-8

www.jist.com

Essential Skills for Digital Literacy- IC3 Module A ~ Courseware 2105-2 - Computing Fundamentals Using Windows XP

CCI Learning Solutions Inc., 2004

ISBN: 1-55332-086-7

www.ccilearning.com

Essential Skills for Digital Literacy- IC3 Module B ~ Courseware 2109-2 - Key Applications Using Microsoft Office 2003

CCI Learning Solutions Inc., 2004

ISBN: 1-55332-087-5

www.ccilearning.com

Essential Skills for Digital Literacy- IC3 Module C ~ Courseware 2118-2 - Living Online Using Windows XP

CCI Learning Solutions Inc., 2004

ISBN: 1-55332-088-3

www.ccilearning.com

Tools for Success - Soft Skills for the Construction Industry, 2nd Edition

National Centre for Construction Education and Research

Pearson Education, Inc., 2004

ISBN: 0-13-109194-8

Appendix B

General Websites

- www.red-seal.ca/Site/index_e.htm (The Interprovincial Standards Red Seal Program)
- www.ccohs.ca/ (Canadian Centre for Occupational Health and Safety)
- trades.exambank.com/index.html (Trades Exam Bank)
- www.hrsdc.gc.ca/en/labour/workplace_health/index.shtml (Workplace Health and Safety)
- www.hrsdc.gc.ca/en/hip/hrp/essential_skills/essential_skills_index.shtml (Human Resources and Social Development Canada-Essential Skills Website)
- www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdtut/index-eng.php (WHMIS)
- www.wcb.pe.ca/index.php3?number=60189 (Worker's Compensation Board of PEI)
- www.gov.pe.ca/educ/index.php3?number=74951 (PEI Apprenticeship Training)
- www.irc.nrc-cnrc.gc.ca/codes/home_E.shtml (Canadian Codes Centre)
- www.canoshweb.org/ (Canada's National Occupational Health and Safety Website)
- www.oshweb.com/ (Index of Occupational Health and Safety Resources)
- www.iapa.on.ca/about_iapa/about_intro.asp (Industrial Accident Prevention Association)
- www.cos-mag.com/ (Canadian Occupational Safety Magazine)
- www.nationalcodes.ca/ (National Code Documents)
- www.theglobeandmail.com/ (The Globe and Mail)
- www.nationalpost.com/ (National Post)
- www.theguardian.pe.ca/ (The Guardian)
- www.cbc.ca/pei/ (CBC-PEI)
- www.cbc.ca (CBC-National)

Websites for Machinists

- www.matweb.com/index.aspx (Database of Material Properties)
- www.metalsuppliersonline.com/research/Default.asp (Machinist-related Information on Various Topics)
- www.jjjtrain.kanabco.com/vms/ (Machine Tool Training and Instruction)
- www.metalinfo.com/partners/amm/metalglossary.cfm (Glossary of Metals)
- www.americanmachinist.com/ (Machinist-related Information on Various Topics)
- www.iamaw.ca/ (International Association of Machinists and Aerospace Workers)
- www.ctma.com/careers/careers_careers.asp (Canadian Tooling and Machining Association)
- www.ntma.org/eweb/StartPage.aspx (National Tooling and Machining Association)
- <http://www.americanmachinist.com/> (American Machinist)

All online resources listed in this document were operational at time of publication.

Writing (W) Learning Outcome – Learners will write to communicate for a variety of purposes.

**W1 Plan the
Writing Process**

1.1 Identify purpose	1.2 Identify audience	1.3 Identify the most effective writing format for task

W2 Write Clear Words, Sentences and Paragraphs

2.1 Use words effectively	2.2 Write effective sentences	2.3 Write effective paragraphs

W3 Use Correct Mechanics

3.1 Use correct spelling	3.2 Use correct punctuation	3.3 Use correct capitalization	3.4 Use correct grammar

W4 Write Business Communications

4.1 Write lists	4.2 Complete forms	4.3 Write notes	4.4 Write memos	4.5 Write letters	4.6 Write resumés
4.7 Write reports					

W5 Edit Business Communications

5.1 Proofread for clarity, tone, accuracy and brevity	5.2 Rewrite for clarity, tone, accuracy and brevity

Learners will write to communicate for a variety of purposes

Introduction

Effective written communication is the backbone of any workplace or organization. More specifically, good communication skills reduce the chance of faulty interpretation which, in turn, allow for maximum productivity.

As the economy changes so too does the workplace. Necessary reorganization and technological change demand that workers who would generally not be responsible for a high level of workplace writing are now expected to communicate internally and externally on a regular basis through memos, emails, faxes and reports.

The following guide is an introduction to the key writing skills workers need to deal effectively with everyday written correspondence and business communications and provides strategies to help learners improve their ability to write.

A list of resources (see Appendix A) has been outlined for each objective in the Writing Curriculum Framework and, where possible, includes online website materials that complement these resources. All information is presented in a generic manner; the contextualization to specific trades will be found in the expected writing tasks of each trade, determined by the instructor.

The following information has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Outlined below are examples of writing tasks performed by tradespeople. These tasks may be used as a basis for writing expectations.

Examples of Writing Tasks

- | | |
|--|-----------------------------------|
| ✓ Incident/accident reports | ✓ Emails/memos |
| ✓ Detailed lists of materials needed for a job | ✓ Quotations |
| ✓ Inventory lists | ✓ Material requests |
| ✓ Brief descriptions of work for invoices | ✓ Daily logbook |
| ✓ Progress notes | ✓ Informative notes to co-workers |
| ✓ Proposals | ✓ Safety guidelines |
| ✓ Meeting minutes | ✓ Technical service reports |

WR1 Plan the Writing Process

Upon completion of this objective, learners will be able to:

- 1.1 identify purpose
- 1.2 identify audience
- 1.3 identify the most effective writing format for task

Resources:

- Making Choices: Teaching Writing in the Workplace
- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, Third Edition

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearreso/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

WR2 Write Clear Words, Sentences and Paragraphs

Upon completion of this learning objective, learners will be able to:

- 2.1 use words effectively
- 2.2 write effective sentences
- 2.3 write effective paragraphs

Resources:

- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Workplace Communications- The Basics, *3rd Edition*

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

WR3 Use Correct Mechanics

Upon completion of this objective, learners will be able to:

- 3.1 use correct spelling
- 3.2 use correct punctuation
- 3.3 use correct capitalization
- 3.4 use correct grammar

Resources:

- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, 3rd Edition

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.ucalgary.ca/UofC/eduweb/grammar/>
- <http://www.khake.com/page66.html>

WR4 Write Business Communications

Upon completion of this objective, learners will be able to:

- 4.1 write lists
- 4.2 complete forms
- 4.3 write notes
- 4.4 write memos
- 4.5 write letters
- 4.6 write resumés
- 4.7 write reports

Resources:

- Making Choices: Teaching Writing in the Workplace
- Applied Communication Skills for the Construction Trades
- Tools for Success: Soft Skills for the Construction Industry, *2nd Edition*
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Effective Workplace Communications-Skills for Success in Life and on the Job, *3rd Edition* (Chapter 6)
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, *3rd Edition*

Online Resources:

- http://oregonstate.edu/dept/eli/buswrite/Business_Writing_Help.html
- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

WR5 Edit Business Communications

Upon completion of this objective, learners will be able to:

- 5.1 proofread written work
- 5.2 rewrite written work for clarity, tone, accuracy and brevity

Resources:

- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, *3rd Edition*

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearreso/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

Appendix A

Resource Materials:

Applied Communication Skills for the Construction Trades

Steven A. Rigolosi
Pearson Education, Inc., 2002
ISBN: 0-13-093355-4

Effective Workplace Communications-Skills for Success in Life and on the Job, 3rd Edition

Marsha Ludden
JIST Works, 2007
ISBN: 978-1-59357-433-8
www.jist.com

Making Choices: Teaching Writing in the Workplace

Diane Millar
Instructional Activities Manual (ISBN: 1-894593-13-8)
Reference Manual (ISBN: 1-894593-12-X)
Grass Roots Press, 2002

Successful Technical Writing- A Practical Approach

Bill Wesley Brown
The Goodheart-Willcox Company Inc., 2000
ISBN: 1-56637-696-3
ISBN (Instructor's Guide): 13-978-1-56637-697-6

Tools for Success: Soft Skills for the Construction Industry, 2nd Edition

National Centre for Construction Education and Research
Contren Learning Series
Pearson Education, Inc., 2004
ISBN: 0-13-160000-1

Workplace Communications- The Basics, 3rd Edition

George J. Searles
Pearson Education, Inc., 2006
ISBN: 0-321-33068-4

Write for Business: A Compact Guide to Writing and Communicating in the Workplace

Verne Meyer, Pat Sebranek, John Van Rys

UpWrite Press, 2004

ISBN (hardcover): 1-932436-00-6

ISBN (spiral): 1-932436-01-4

All online resources listed in this document were operational at time of publication.

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CONDITIONING MECHANIC
NOC 7313**

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SECTION 1 - INTRODUCTION

Points to Consider

- 80% of learning in a trade happens in the workplace.
- Every workplace in every province and territory has its own unique learning culture.
- Each journey person has their individual approach to guiding an apprentice.
- Every apprentice will write the **same** National exam.

Background

The road to a trade certification has many paths. For an apprentice who has not taken the pre-apprentice training and Block/Period/Level in-school route, it can be a difficult road to navigate. The primary focus appears to be accumulating enough hours for eligibility to challenge the Interprovincial Red Seal exam.

The one tool that is available, if an apprentice chooses the Block/Period/Level route, is the Provincial Logbook. This Logbook tracks the Blocks, Tasks and Sub-tasks that an apprentice has learned in the workplace. For apprentices who have chosen the route on which 100% of their learning happens in the workplace, it can be difficult to “know what you don’t know.” On this path the apprentices never had a Logbook so in order to challenge, they have their journey person sign off on the Blocks when they have accumulated the hours required to challenge the IP certification exam in their trade.

Provincial/Territorial Logbooks are developed from the National Occupational Analysis (NOA) in a trade. Most apprentices are never introduced to the NOA of their trade even though it is used to develop trades curriculum, block/period/level tests and the IP exam.

Technical Skills Inventory (TSI)

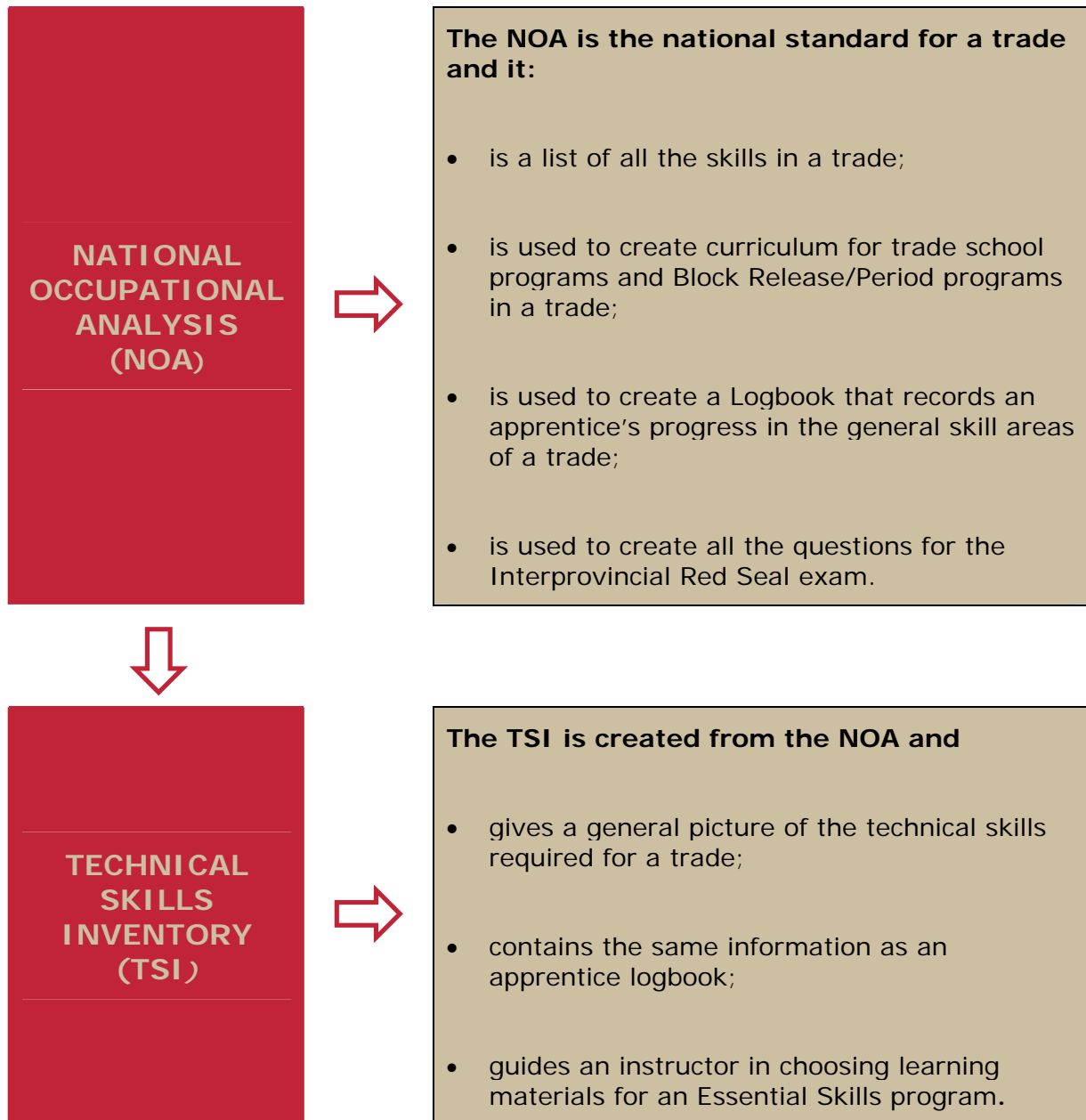
The Technical Skills Inventory (TSI) is created from the NOA. It is a self-assessment tool designed to give the apprentices the opportunity to reflect on their technical skills, identify skills gaps and make a plan to fill those gaps **before** they challenge the IP exam.

The TSI also provides information for Essential Skills assessors to create technical skills learning plans for individual apprentices and Essentials Skills program instructors. These learning plans are used by the instructor and the apprentice to select technical skills resources that support Essential Skills learning programs.

Feature

The TSI “Group Summary” has formulas imbedded so data can be easily extracted and manipulated for presentation in a pie chart format.

**SECTION 2 - NATIONAL OCCUPATIONAL ANALYSIS (NOA) –
TECHNICAL SKILLS INVENTORY (TSI) DIAGRAM**



SECTION 3 - ASSESSOR'S GUIDE

STEP ONE: INTRODUCE PARTICIPANTS TO THE NATIONAL OCCUPATIONAL ANALYSIS (NOA)

Rationale

National Occupational Analysis (NOA)

The NOA is recognized as the national standard for all trades. There is an NOA for each trade in Canada and, although the NOAs are readily accessible online, few tradespeople take advantage of this information. (To access NOAs on line, go to www.red-seal.ca and click on National Occupational Analysis)

NOA Background

An NOA is reviewed and revised at least every 5 years. Each NOA is developed by a Joint Planning Committee and the Interprovincial Program Guide Working Group, comprised of industry and instructional representatives in a specific trade from each province and territory in Canada. All Joint Planning Committees operate under the auspices of the Canadian Council of Directors of Apprenticeship (CCDA) who recognize the NOA as the key document in an occupation. The CCDA consists of directors/managers of apprenticeship from every province and territory in Canada.

The NOA:

- Lists every technical skill requirement in a trade;
- Is used to create the Apprentice Logbook in a trade;
- Is used to develop curriculum for trades training programs; and
- Is used to develop the questions for Interprovincial Red Seal exam.

Activity

Preparation

Have an NOA printed for each participant. Ensure each NOA has page indicators at these sections:

- Analysis
- Tools and Equipment
- Glossary
- Exam Components

NOTE: Move pie chart to the first page of the exam component section.

Timeline

The first night of class

Direction

Ask the participants if they have ever used or worked in an NOA before. If so, engage them in a discussion of where they used it and in what context. Then:

- Distribute an NOA to each participant;
- Review the development and layout of the document;
- Emphasize the use of the document, e.g., creating a logbook, curriculum, possible exam questions, etc.; and
- Review each section of the document with particular attention to the Blocks, Tasks and sub-tasks in the Analysis section.

STEP TWO: INTRODUCE PARTICIPANTS TO THE TECHNICAL SKILLS INVENTORY (TSI)

Rationale

Technical Skills Inventory (TSI)

The TSI is created from the NOA. It gives a general picture of the technical skills required for a trade by listing the **Blocks**, **Tasks** and **Sub-tasks** in the trade. The TSI:

- Contains the same information as the Apprentice Logbook in a trade;
- Provides the participant with an opportunity to **self-assess** his/her general skills in their trade; and
- Guides the instructor in choosing contextualized resources for the Essential Skills program.

TSI Terminology

Two sets of terms can be used depending on where a participant learns and works in their trade. In this TSI document, you will find the **common terminology** listed first. It is followed by the **competency-based terminology** in italics and underlined.

TSI Terminology

Blocks - Learning Categories: Tasks - Learning Outcomes:
Sub-tasks - Learning Objectives

By completing this Technical Skills Inventory (TSI) the participant will:

- be introduced to the **blocks** (*learning categories*), the **tasks** (*learning outcomes*), and the **sub-tasks** (*learning objectives*) in the NOA;
- reflect on their technical skills, then list what they know and can do;
- document any technical skills gaps the participant may have;
- help create a group learning needs profile to assist curriculum developers and the instructor gather learning materials specific to a trade for an Essential Skills Program; and
- help the participant make a plan for any technical skills they may need to learn or improve

Activity

Preparation

Print an NOA Analysis Diagram for each participant.

Print a Learner's Guide – Technical Skills Inventory (TSI).

Print a personalized TSI for each participant.

Timeline

The first night of class

Direction

Distribute an NOA Analysis Diagram to each participant in the program and review the content with him/her. Then:

- Distribute the Learner's Guide – Technical Skills Inventory (TSI) to each participant;
- Distribute the personalized TSI to each participant;
- Summarize the directions for completing the TSI;
- Advise the participants to review each sub-task and put a ✓ in the column that best describes their self-assessment of their skill:
 - Yes, I did this
 - I need to work on this
 - Not sure what this means
- Advise participants to include any comments they may have; and
- Collect TSIs when participants have completed them.

It should take approximately 20 minutes for a participant to complete their individual TSI. If some take longer, do not rush them.

Advise participants that you will meet with them at the **half-way** point of the program to give them feedback on their TSI. Advise them that in the meantime, you will be collecting the information from each TSI and compiling it for the instructor so he/she can prepare materials for the Essential Skills Program.

STEP THREE: COMPILE DATA FOR THE INSTRUCTOR

Rationale

The Essential Skills Programs at Trade Essentials are contextualized to the trade. This results in participants being easily engaged in their learning because they relate to the materials that support concepts and applications in their trade. Data collected through the TSI guides the instructor as to what contextual and technical resources will best engage his/her participants.

Timeline

Within 24 to 48 hours of the participants completing the TSI, provide the instructor with a **TSI Group Summary Chart** and **Group Learning Plan**.


Activity

Preparation

Develop a TSI Group Summary Chart

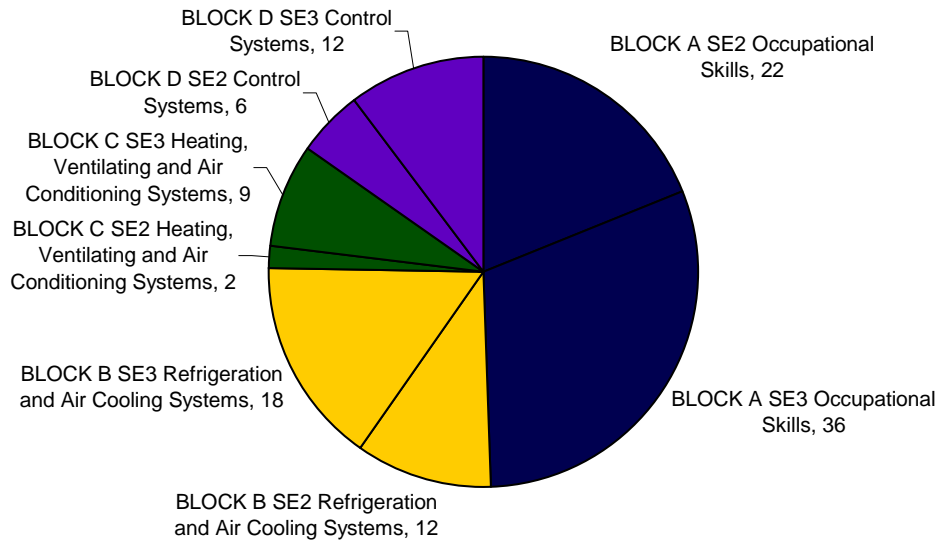
- Complete an Excel spreadsheet assigning one column to each participant;
- Assign the number code to each TSI column
 - 0 to the first column – Yes, I did this
 - 2 to the second column – I need to work on this
 - 3 to the third column – Not sure what this means
- Collect the data from the TSI and transfer it to the spreadsheet; and
- The 2s will automatically highlight in **yellow** and the 3s in **blue** so the instructor can easily identify a participant who has a learning need that differs significantly from the group;
- A group summary chart will appear at the bottom of your spreadsheet.

Direction

- Create a pie chart to produce a visual depiction of a group's learning needs
 - Highlight the entire "Summary Chart" on the last page of your spreadsheet.
 - On the tool bar, choose the "Chart Wizard" (Microsoft Office Excel 2003) 
 - Under chart "Chart type" choose "Pie"
 - Under "Chart Sub-Type" choose the first Pie picture
 - Click "Next"
 - Choose "Data Range" and "Columns" then click "Next"
 - Choose "Titles" and fill in "Chart Name" (Group Location and Trade)
 - On the same tool bar, choose "Legend" then "Bottom"
 - On the same tool bar choose "Data Labels" then choose "Category Name," "Value," and "Legend Key," then click "Next"
 - Under "Chart Location" choose "As New Sheet" and click "Finish"
 - To change a colour of a piece of the pie chart so 2s and 3s in the same piece of the pie match,
 - click inside the pie
 - click on the piece of pie you want to change
 - double click on that same piece and the colour chart will appear
 - choose your colour
 - To move or adjust items in the pie chart, right click on the pie chart, choose "Edit" then choose the item you want to adjust or move. Click outside the chart when you are finished
 - Choose "Edit", then "Copy" the pie chart and "Paste" it into the "Group Learning Plan"
- Provide the instructor with a copy of both the **TSI Group Summary Chart** and the **Group Learning Plan** within 24 to 48 hours so he/she can choose appropriate learning resources; and put one copy of the TSI Group Summary and the Group Learning Plan Pie Chart in the office files.

Sample Pie Chart

Group Learning Plan Refrigeration and Air Conditioning Mechanic, Montague



■ BLOCK A SE2 Occupational Skills	■ BLOCK A SE3 Occupational Skills
■ BLOCK B SE2 Refrigeration and Air Cooling Systems	■ BLOCK B SE3 Refrigeration and Air Cooling Systems
■ BLOCK C SE2 Heating, Ventilating and Air Conditioning Systems	■ BLOCK C SE3 Heating, Ventilating and Air Conditioning Systems
■ BLOCK D SE2 Control Systems	■ BLOCK D SE3 Control Systems

STEP FOUR: ASSIST THE PARTICIPANT TO DEVELOP AN INDIVIDUAL TECHNICAL SKILLS LEARNING PLAN

Rationale

Information from the TSI is used to create an individual report for each participant. This report includes:

- Information on the TSI so the participant has a record of how he/she completed this tool;
- A Pie Chart that provides a visual depiction of the participant's learning needs; and
- A series of questions that result in each participant developing an individual technical skills learning plan.

Timeline

At the **mid-point** of the Essential Skills Program, provide participants with feedback on their TSI. This timeline:


- gives the participant an opportunity to focus entirely on their Essential Skills for the first few weeks of the program;
- gives the participant time to evaluate if, through their Essential Skills studies, they have discovered that their technical learning needs are more extensive than they previously assessed through their TSI;
- creates an opportunity for the participant to share how they are adjusting to a learning environment with someone other than the instructor; and
- provides an opportunity for the assessor to gather information from each participant to determine if resources and instruction are meeting their learning needs.

Activity

Preparation

Develop an Individual Learning Needs Plan Pie Chart for each participant to produce a visual depiction of a participant's learning needs.

Direction

- Transfer each participant's total for each Block (both SE 2 - I need to work on this and SE 3 - Not sure what this means) into a Pie Chart;
 - Highlight all of the Block titles in the "Summary Chart" on the last page of the spreadsheet
 - Hold down the Control Key (Ctrl) on your keyboard
 - Highlight one client column
 - On the tool bar, choose the "Chart Wizard" (Microsoft Office Excel 2003) 
 - Under "Chart type" choose "Pie"
 - Under "Chart Sub-Type" choose the first Pie picture
 - Click "Next"
 - Choose "Data Range" and "Columns" then click "Next"
 - Choose "Titles" and fill in "Chart Name" (Client name and Trade)
 - On the same tool bar, choose "Legend" then "Bottom"
 - On the same tool bar choose "Data Labels" then choose "Category Name," "Value" and "Legend Key", then click "Next"
 - Under "Chart Location" choose "As New Sheet" and click "Finish"
 - To change a colour of a piece of the pie chart so 2s and 3s in the same piece of the pie match,
 - click inside the pie
 - click on the piece of pie you want to change
 - double click on that same piece and the colour chart will appear
 - choose your colour
 - To move or adjust items in the pie chart, right click on the pie chart, choose "Edit" then choose the item you want to adjust or move. Click outside the chart when you are finished.
 - Choose "Edit", then "Copy" the pie chart and "Paste" it into the "Individual Learning Plan"

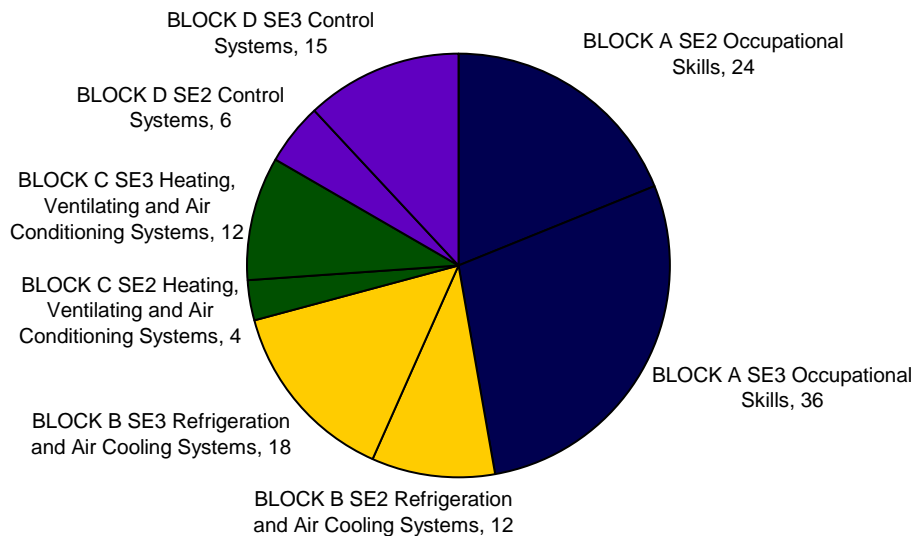
Feedback

- Schedule a one-on-one TSI feedback appointment with each participant during which you compare and discuss their Individual Learning Needs Pie Chart with the Group Learning Needs Pie Chart
- Complete the **Individual Learning Plan** with the participant.
- Make 2 copies of the Individual Learning Plan. Put one copy in office file and one copy in your files.
- Give the original TSI and the original Individual Learning Plan back to the participant.

Each one-on-one meeting with a client should average 20 to 30 minutes.

Sample Pie Chart

J. Doe - Individual Learning Plan - Refrigeration and Air Conditioning Mechanic, Montague



■ BLOCK A SE2 Occupational Skills	■ BLOCK A SE3 Occupational Skills
■ BLOCK B SE2 Refrigeration and Air Cooling Systems	■ BLOCK B SE3 Refrigeration and Air Cooling Systems
■ BLOCK C SE2 Heating, Ventilating and Air Conditioning Systems	■ BLOCK C SE3 Heating, Ventilating and Air Conditioning Systems
■ BLOCK D SE2 Control Systems	■ BLOCK D SE3 Control Systems

SECTION 4 - LEARNER'S GUIDE

Key Document in your Trade

The National Occupational Analysis (NOA) is a trade document approved nationally and used in each Province and Territory across Canada. The NOA lists every technical skill required to be successful in your trade. Each NOA is used to:

- create the Apprentice Logbook in your trade;
- develop curriculum for trades training programs; and
- prepare questions for Red Seal exams.

Technical Skills Inventory (TSI)

The TSI is created from the NOA. It gives a general overview of the technical skills required for your trade by listing the Blocks, Tasks and Sub-Tasks in your trade. The TSI:

- contains the same information as the Apprentice Logbook in your trade; and
- gives you the opportunity to self-assess your general skills in your trade.

TSI Terms

Two sets of terms can be used depending on where you learn and work in your trade. In this TSI document you will find the **common terms** listed first. It is followed by the **competency-based terms** in italics and underlined. (*In the future, all NOA updates will be using competency-based terms.*)

TSI Terms

Common Terms

Blocks _____

Tasks _____

Sub-tasks _____

Competency-based Terms

Learning Categories

Learning Outcomes

Learning Objectives

Why complete a TSI?

By completing this Technical Skills Inventory (TSI):

- you will be introduced to the **blocks** (*learning categories*), the **tasks** (*learning outcomes*) and the **sub-tasks** (*learning objectives*) in the NOA;
- it will help you think about your technical skills, then help you list what you know and can do;
- it will help you highlight any technical skills gaps you may have;
- it will help create a group learning needs profile to assist the instructor gather learning materials specific to your trade and your learning needs for your Essential Skills Program; and
- it will help you make a plan to get any technical skills you may need to learn or skills you may want to improve.

Directions

Review each sub-task and put a ✓ in the column that best describes your self-assessment of your skills:

- Yes, I did this
- I need to work on this
- Not sure what this means

Include any comments that may help the instructor choose learning materials for you.

NAME:

DATE:

Block A – Learning Category
OCCUPATIONAL SKILLS

Task 1 – Block A <u>Learning Outcome</u> Utilizes mechanical and architectural drawings, acts, codes, standards, legislation, and service and operating manuals		Yes, I did this	I need to work on this	Not sure what this means	Comments
A 1.01	Interprets blueprints, drawings and schematics				
A 1.02	Interprets service and operating manuals, technical bulletins and warranties				
A 1.03	Interprets tables, charts and diagrams				
A 1.04	Interprets manufacturer's specifications				
A 1.05	Complies with government acts, codes, standards and regulations				

Task 2 – Block A <u>Learning Outcome</u> Operates and maintains tools and equipment		Yes, I did this	I need to work on this	Not sure what this means	Comments
A 2.01	Utilizes hand tools				
A 2.02	Utilizes portable and stationary power tools				
A 2.03	Utilizes oxy-fuel and air-fuel equipment				
A 2.04	Utilizes recovery and recycle equipment				
A 2.05	Utilizes evacuation equipment and tools				
A 2.06	Utilizes charging equipment and tools				
A 2.07	Utilizes access/egress equipment				
A 2.08	Utilizes hoisting and rigging equipment				
A 2.09	Utilizes mechanical measuring equipment				
A 2.10	Utilizes electric and electronic diagnostic tools				
A 2.11	Utilizes computer equipment to interface with refrigeration and air conditioning systems				
Task 3 – Block A <u>Learning Outcome</u> Demonstrates work practices & procedures					
A 3.01	Installs fasteners, brackets and hangers				
A 3.02	Performs lock-out tagging and isolation procedures				
A 3.03	Installs piping and tubing				
A 3.04	Applies sealants and adhesives				
A 3.05	Cleans and lubricates parts and components				
A 3.06	Performs internal electrical wiring of systems				

Task 4 – Block A <u>Learning Outcome</u> Coordinates refrigeration and air conditioning installation and maintenance		Yes, I did this	I need to work on this	Not sure what this means	Comments
A 4.01	Estimates work requirements				
A 4.02	Conducts work area inspection				
A 4.03	Coordinates work requirements				
A 4.04	Maintains customer relations				
A 4.05	Clarifies end user problems with refrigeration and air conditioning systems				
A 4.06	Completes work-related documentation				
A 4.07	Generates maintenance documentation				
Task 5 – Block A <u>Learning Outcome</u> Performs system components, accessories and materials acquisition and handling					
A 5.01	Requisitions equipment				
A 5.02	Receives materials/equipment				
A 5.03	Transfers equipment to designated location				

Block B – *Learning Category*
REFRIGERATION AND AIR COOLING SYSTEMS

Task 6 – Block B <i>Learning Outcome</i> Plans installation of refrigeration and air cooling systems		Yes, I did this	I need to work on this	Not sure what this means	Comments
B 6.01	Verifies refrigeration and air cooling system parameters and requirements				
B 6.02	Selects refrigeration and air cooling components, equipment and accessories				
B 6.03	Prepares components, equipment and accessories layout				
B 6.04	Selects refrigerant				
B 6.05	Sizes piping				
B 6.06	Lays out piping				
B 6.07	Selects insulation				
Task 7 – Block B <i>Learning Outcome</i> Installs refrigeration and air cooling systems					
B 7.01	Prepares site/location				
B 7.02	Assembles refrigeration and air cooling components, equipment and accessories				
B 7.03	Positions and secures refrigeration and air cooling components, equipment and accessories				
B 7.04	Routes and connects refrigerant piping				
B 7.05	Performs leak test on system				
B 7.06	Evacuates system				
B 7.07	Charges system				

Task 8 – Block B <i>Learning Outcome</i> Commissions refrigeration and air cooling systems		Yes, I did this	I need to work on this	Not sure what this means	Comments
B 8.01	Performs pre-start-up checks				
B 8.02	Starts up refrigeration and air conditioning system				
B 8.03	Completes system charge				
B 8.04	Sets up primary and secondary refrigeration system adjustable switches, valves and regulators				
Task 9 – Block B <i>Learning Outcome</i> Maintains refrigeration and air cooling systems					
B 9.01	Inspects refrigeration and air cooling systems				
B 9.02	Tests electrical and electronic components				
B 9.03	Tests mechanical components				
B 9.04	Recommends corrective action				
B 9.05	Selects refrigeration and air cooling equipment and components				
B 9.06	Replaces defective components and equipment				
B 9.07	Repairs/overhauls defective components and equipment				
B 9.08	Verifies refrigeration and air cooling system and component function				
B 9.09	Performs predictive maintenance				
B 9.10	Performs preventative maintenance				

Block C – *Learning Category*
HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

Task 10 – Block C <i>Learning Outcome</i> Plans installation of heating, ventilating and air conditioning systems		Yes, I did this	I need to work on this	Not sure what this means	Comments
C 10.01	Verifies heating, ventilating and air conditioning systems, parameters and requirements				
C 10.02	Selects heating, ventilating and air conditioning components and equipment				
C 10.03	Confirms heating, ventilating and air conditioning requirements				
Task 11 – Block C <i>Learning Outcome</i> Installs heating, ventilating and air conditioning systems					
C 11.01	Prepares heating, ventilating and air conditioning equipment site/location				
C 11.02	Assembles heating, ventilating and air conditioning equipment				
C 11.03	Positions and secures heating, ventilating and air conditioning equipment				
Task 12 – Block C <i>Learning Outcome</i> Commissions heating, ventilating and air conditioning systems					
C 12.01	Performs pre-start-up checks				
C 12.02	Starts up heating, ventilating and air conditioning systems				

Task 13 – Block C <i>Learning Outcome</i> Maintains heating, ventilating and air conditioning systems		Yes, I did this	I need to work on this	Not sure what this means	Comments
C 13.01	Inspects heating, ventilating and air conditioning systems				
C 13.02	Tests electrical/electronic components in heating, ventilating and air conditioning systems				
C 13.03	Tests mechanical components in heating, ventilating and air conditioning systems				
C 13.04	Recommends corrective action				
C 13.05	Selects heating, ventilating and air conditioning equipment and components				
C 13.06	Replaces defective heating, ventilating and air conditioning components and equipment				
C 13.07	Repairs/overhauls defective components and equipment for heating, ventilating and air conditioning systems				
C 13.08	Verifies heating, ventilating and air conditioning systems and component function				
C 13.09	Performs predictive maintenance on heating system				
C 13.10	Performs preventative maintenance on heating, ventilating and air conditioning systems				

Block D – *Learning Category*
CONTROL SYSTEMS

Task 14 – Block D <i>Learning Outcome</i> Plans installation of control systems		Yes, I did this	I need to work on this	Not sure what this means	Comments
D 14.01	Selects controls				
D 14.02	Lays out control system components and wiring				
Task 15 – Block D <i>Learning Outcome</i> Installs control systems					
D 15.01	Prepares site/location for control system				
D 15.02	Positions and secures control system components				
D 15.03	Connects system wiring and tubing				
Task 16 – Block D <i>Learning Outcome</i> Commissions control systems					
D 16.01	Performs pre-start-up checks				
D 16.02	Sets operating parameters				
D 16.03	Starts up control system				

Task 17 – Block D <u>Learning Outcome</u> Maintains control systems		Yes, I did this	I need to work on this	Not sure what this means	Comments
D 17.01	Inspects control system				
D 17.02	Verifies and resets operating parameters				
D 17.03	Tests electrical/electronic components in control system				
D 17.04	Tests mechanical components in control system				
D 17.05	Recommends corrective action				
D 17.06	Selects control system equipment and components				
D 17.07	Replaces defective control components and equipment				
D 17.08	Repairs/overhauls defective components and equipment for control system				
D 17.09	Verifies control system component function				
D 17.10	Performs preventative maintenance on control system				
D 17.11	Calibrates operating and safety controls				

Trade Essentials

Technical Skills Inventory (TSI) Group Summary

Refrigeration and Air Conditioning Mechanic - (NOA) National Occupational Analysis
2004)

NOC 7313 (National Occupational Classification)



		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK A (Learning Category) FUNDAMENTAL OCCUPATIONAL SKILLS													
Task 1 (Learning Outcome) - Utilizes mechanical and architectural drawings, acts, codes, standards, legislation, and service and operating manuals													
Sub-Tasks (Learning Objectives)												TOTALS	
A 1.01	Interprets blueprints, drawings and schematics											0	A 1.01
A 1.02	Interprets service and operating manuals, technical bulletins and warranties											0	A 1.02
A 1.03	Interprets tables, charts and diagrams											0	A 1.03
A 1.04	Interprets manufacturer's specifications											0	A 1.04
A 1.05	Complies with government acts, codes, standards and regulations											0	A 1.05
Task 2 (Learning Outcome) - Operates and maintains tools and equipment												Task Total	0
Sub-Tasks (Learning Objectives)													
A 2.01	Utilizes hand tools											0	A 2.01
A 2.02	Utilizes portable and stationary power tools											0	A 2.02
A 2.03	Utilizes oxy-fuel and air-fuel equipment											0	A 2.03
A 2.04	Utilizes recovery and recycle equipment											0	A 2.04
A 2.05	Utilizes evacuation equipment and tools											0	A 2.05
A 2.06	Utilizes charging equipment and tools											0	A 2.06
A 2.07	Utilizes access/egress equipment											0	A 2.07
A 2.08	Utilizes hoisting and rigging equipment											0	A 2.08
A 2.09	Utilizes mechanical measuring equipment											0	A 2.09
A 2.10	Utilizes electric and electronic diagnostic tools											0	A 2.10
A 2.11	Utilizes computer equipment to interface with refrigeration and air conditioning systems											0	A 2.11
Task 3 (Learning Outcome) - Demonstrates work practices and procedures												Task Total	0
Sub-Tasks (Learning Objectives)													
A 3.01	Installs fasteners, brackets and hangers											0	A 3.01
A 3.02	Performs lock-out tagging and isolation procedures											0	A 3.02
A 3.03	Installs piping and tubing											0	A 3.03
A 3.04	Applies sealants and adhesives											0	A 3.04
A 3.05	Cleans and lubricates parts and components											0	A 3.05
A 3.06	Performs internal electrical wiring of systems											0	A 3.06
Task 4 (Learning Outcome) - Coordinates refrigeration and air conditioning installa												Task Total	0
Sub-Tasks (Learning Objectives)													
A 4.01	Estimates work requirements											0	A 4.01
A 4.02	Conducts work area inspection											0	A 4.02
A 4.03	Coordinates work requirements											0	A 4.03
A 4.04	Maintains customer relations											0	A 4.04
A 4.05	Clarifies end user problems with refrigeration and air conditioning systems											0	A 4.05
A 4.06	Completes work-related documentation											0	A 4.06
A 4.07	Generates maintenance documentation											0	A 4.07
Task 5 (Learning Outcome) - Performs system components, accessories and materials acquisition and handling												Task Total	0
Sub-Tasks (Learning Objectives)													
A 5.01	Requisitions equipment											0	A 5.01
A 5.02	Receives materials/equipment											0	A 5.02
A 5.03	Transfers equipment to designated location											0	A 5.03
BLOCK A TOTALS		0	0	0	0	0	0	0	0	0	0	Task Total	0
												0	0

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK B (Learning Category) REFRIGERATION AND AIR COOLING SYSTEMS													
Task 6 (Learning Outcome) - Plans installation of refrigeration and air cooling systems													
Sub-Tasks (Learning Objectives)												TOTALS	
B 6.01	Verifies refrigeration and air cooling system parameters and requirements											0	B 6.01
B 6.02	Selects refrigeration and air cooling components, equipment and accessories											0	B 6.02
B 6.03	Prepares components, equipment and accessories layout											0	B 6.03
B 6.04	Selects refrigerant											0	B 6.04
B 6.05	Sizes piping											0	B 6.05
B 6.06	Lays out piping											0	B 6.06
B 6.07	Selects insulation											0	B 6.07
Task 7 (Learning Outcome) - Installs refrigeration and air cooling systems												Task Total	0
Sub-Tasks (Learning Objectives)													
B 7.01	Prepares site/location											0	B 7.01
B 7.02	accessories											0	B 7.02
B 7.03	Positions and secures refrigeration and air cooling components, equipment and accessories											0	B 7.03
B 7.04	Routes and connects refrigerant piping											0	B 7.04
B 7.05	Performs leak test on system											0	B 7.05
B 7.06	Evacuates system											0	B 7.06
B 7.07	Charges system											0	B 7.07
Task 8 (Learning Outcome) - Commissions refrigeration and air cooling systems												Task Total	0
Sub-Tasks (Learning Objectives)													
B 8.01	Performs pre-start-up checks											0	B 8.01
B 8.02	Starts up refrigeration and air conditioning system											0	B 8.02
B 8.03	Completes system charge											0	B 8.03
B 8.04	Sets up primary and secondary refrigeration system adjustable switches, valves and regulators											0	B 8.04
Task 9 (Learning Outcome) - Maintains refrigeration and air cooling systems												Task Total	0
Sub-Tasks (Learning Objectives)													
B 9.01	Inspects refrigeration and air cooling systems											0	B 9.01
B 9.02	Tests electrical and electronic components											0	B 9.02
B 9.03	Tests mechanical components											0	B 9.03
B 9.04	Recommends corrective action											0	B 9.04
B 9.05	Selects refrigeration and air cooling equipment and components											0	B 9.05
B 9.06	Replaces defective components and equipment											0	B 9.06
B 9.07	Repairs/overhauls defective components and equipment											0	B 9.07
B 9.08	Verifies refrigeration and air cooling system and component function											0	B 9.08
B 9.09	Performs predictive maintenance											0	B 9.09
B 9.10	Performs preventative maintenance											0	B 9.10
BLOCK B TOTALS		0	0	0	0	0	0	0	0	0	0	Task Total	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0

Date:
Group Identification:
Instructor:
REFRIGERATION / AC MECHANIC

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

BLOCK C (Learning Category) HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS												Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10				
Task 10 (Learning Outcome) - Plans installation of heating, ventilating and air conditioning systems																									
Sub-Tasks (Learning Objectives)												TOTALS													
C 10.01	Verifies heating, ventilating and air conditioning systems, parameters and requirements																				0	C 10.01			
C 10.02	Selects heating, ventilating and air conditioning components and equipment																				0	C 10.02			
C 10.03	Confirms heating, ventilating and air conditioning requirements																				0	C 10.03			
Task 11 (Learning Outcome) - Installs heating, ventilating and air conditioning systems												Task Total		0											
Sub-Tasks (Learning Objectives)																									
D 11.01	Prepares heating, ventilating and air conditioning equipment site/location																				0	D 11.01			
C 11.02	Assembles heating, ventilating and air conditioning equipment																				0	C 11.02			
C 11.03	Positions and secures heating, ventilating and air conditioning equipment																				0	C 11.03			
Task 12 (Learning Outcome) - Commissions heating, ventilating and air conditioning systems												Task Total		0											
Sub-Tasks (Learning Objectives)																									
C 12.01	Performs pre-start-up checks																				0	C 12.01			
C 12.02	Starts up heating, ventilating and air conditioning systems																				0	C 12.02			
Task 13 (Learning Outcome) - Maintains heating, ventilating and air conditioning systems												Task Total		0											
Sub-Tasks (Learning Objectives)																									
C 13.01	Inspects heating, ventilating and air conditioning systems																				0	C 13.01			
C 13.02	Tests electrical/electronic components in heating, ventilating and air conditioning systems																				0	C 13.02			
C 13.03	systems																				0	C 13.03			
C 13.04	Recommends corrective action																				0	C 13.04			
C 13.05	Selects heating, ventilating and air conditioning equipment and components																				0	C 13.05			
C 13.06	Replaces defective heating, ventilating and air conditioning components and equipment																				0	C 13.06			
C 13.07	Repairs/overhauls defective components and equipment for heating, ventilating and air conditioning systems																				0	C 13.07			
C 13.08	function																				0	C 13.08			
C 13.09	Performs predictive maintenance on heating system																				0	C 13.09			
C 13.10	Performs preventative maintenance on heating, ventilating and air conditioning systems																				0	C 13.10			
BLOCK C TOTALS												0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE 2												0	0	0	0	0	0	0	0	0	0	0	0	0	
SE 3												0	0	0	0	0	0	0	0	0	0	0	0	0	

Date:
Group Identification:
Instructor:
REFRIGERATION / AC MECHANIC

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

												Client 1	Client 2	Client 3	Client 4	Client 5	Client 1	Client 2	Client 3	Client 4	Client 5		
BLOCK D (Learning Category) CONTROL SYSTEMS																							
Task 14 (Learning Outcome) - Plans installation of control systems																							
Sub-Tasks (Learning Objectives)																						TOTALS	
D 14.01 Selects controls																						0	D 14.01
D 14.02 Lays out control system components and wiring																						0	D 14.02
Task 15 (Learning Outcome) - Installs control systems																						Task Total 0	
Sub-Tasks (Learning Objectives)																							
D 15.01 Prepares site/location for control system																						0	D 15.01
D 15.02 Positions and secures control system components																						0	D 15.02
D 15.03 Connects system wiring and tubing																						0	D 15.03
Task 16 (Learning Outcome) - Commissions control systems																						Task Total 0	
Sub-Tasks (Learning Objectives)																							
D 16.01 Performs pre-start-up checks																						0	D 16.01
D 16.02 Sets operating parameters																						0	D 16.02
D 16.03 Starts up control system																						0	D 16.03
Task 17 (Learning Outcome) - Maintains control systems																						Task Total 0	
Sub-Tasks (Learning Objectives)																							
D 17.01 Inspects control system																						0	D 17.01
D 17.02 Verifies and resets operating parameters																						0	D 17.02
D 17.03 Tests electrical/electronic components in control system																						0	D 17.03
D 17.04 Tests mechanical components in control system																						0	D 17.04
D 17.05 Recommends corrective action																						0	D 17.05
D 17.06 Selects control system equipment and components																						0	D 17.06
D 17.07 Replaces defective control components and equipment																						0	D 17.07
D 17.08 Repairs/overhauls defective components and equipment for control system																						0	D 17.08
D 17.09 Verifies control system component function																						0	D 17.09
D 17.10 Performs preventative maintenance on control system																						0	D 17.10
D 17.11 Calibrates operating and safety controls																						0	D 17.11
BLOCK D TOTALS												0	0	0	0	0	0	0	0	0	0	Task Total 0	
SE 2												0	0	0	0	0	0	0	0	0	0	0	0
SE 3												0	0	0	0	0	0	0	0	0	0	0	0

Group Summary Chart

BLOCK A SE2 Occupational Skills	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK A SE3 Occupational Skills	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK B SE2 Refrigeration and Air Cooling Systems	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK B SE3 Refrigeration and Air Cooling Systems	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK C SE2 Heating, Ventilating and Air Conditioning Systems	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK C SE3 Heating, Ventilating and Air Conditioning Systems	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK D SE2 Control Systems	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK D SE3 Control Systems	0	0	0	0	0	0	0	0	0	0	0	0

Date:
Group Identification:
Instructor:
REFRIGERATION / AC MECHANIC

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

SECTION 7 - GROUP LEARNING PLAN AND PIE CHART (SAMPLE)

Group Learning Plan – Group ID	
Date TSI Completed	
Instructor	

The Technical Skills Inventory (TSI) is designed to:

- introduce apprentices to the blocks (*learning categories*), the tasks (*learning outcomes*), and sub-tasks (*learning objectives*) in the National Occupational Analysis (NOA).
- have apprentices **reflect** and then **self-assess** their tasks (*learning outcomes*) and sub-tasks (*learning objectives*) in their trade.
- compile information from the TSI to **create a group profile** of technical skills learning needs.
- provide information from the TSIs to assist instructors in choosing contextualized and technical skills resources to support Essential Skills curriculum that will support client needs.

The TSI assessment tool lists the block (*learning categories*), tasks (*learning outcomes*) and sub-tasks (*learning objectives*) identified in the National Occupational Analysis (NOA) of each trade. The TSI is a **self-assessment** tool through which an apprentice reflects and records their personal evaluation on each task and sub-task. Self Evaluation (SE) categories for the tasks (*learning outcomes*) and sub-tasks (*learning objectives*) are:

SE 0 – Yes, I did this

SE 2 – I need to work on this

SE 3 – Not sure what this means

GENERAL GROUP PROFILE: Refrigeration and Air Conditioning, Montague

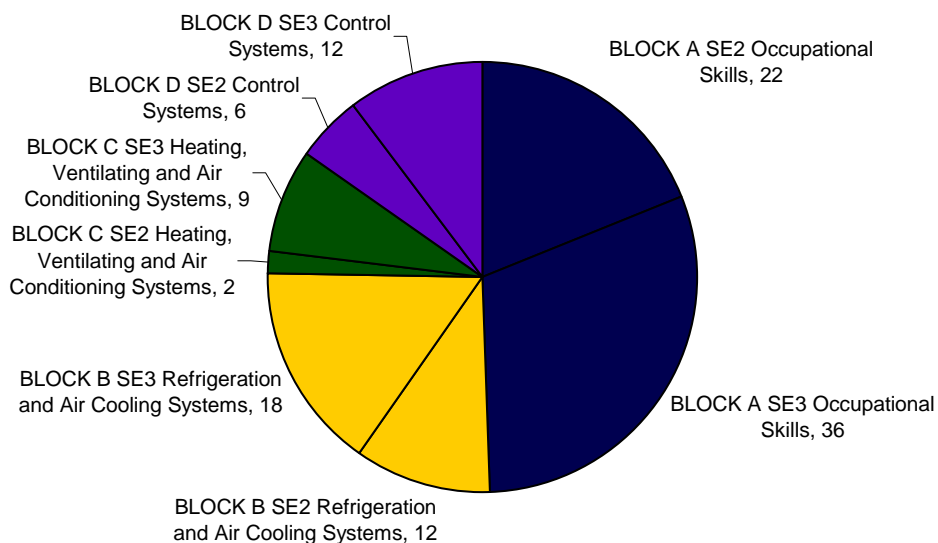
Ten Refrigeration and Air Conditioning learners are participating in this program. The geographic territory covers from the central part to the eastern tip of PEI. Trade expertise within the group ranges from those working in specific sections of the trade to those who own their own businesses. Two have previously challenged but were unsuccessful in the Red Seal exam. All have attended pre-apprenticeship training in a post-secondary institution.

Group Learning Plan Pie Chart Technical Skills Inventory (TSI) Group Learning Needs Profile

NOTE: Any divided section with the same colour that may occur in the chart, highlights where both SE 2 and SE 3 are recorded in the same block.

Self-evaluation (SE)	0 – Yes, I can do this
Self-evaluation (SE)	2 – I need to work on this
Self-evaluation (SE)	3 – Not sure what this means

Group Learning Plan Refrigeration and Air Conditioning Mechanic, Montague



■ BLOCK A SE2 Occupational Skills	■ BLOCK A SE3 Occupational Skills
■ BLOCK B SE2 Refrigeration and Air Cooling Systems	■ BLOCK B SE3 Refrigeration and Air Cooling Systems
■ BLOCK C SE2 Heating, Ventilating and Air Conditioning Systems	■ BLOCK C SE3 Heating, Ventilating and Air Conditioning Systems
■ BLOCK D SE2 Control Systems	■ BLOCK D SE3 Control Systems

SECTION 8 - INDIVIDUAL LEARNING PLAN AND PIE CHART (SAMPLE)

The Technical Skills Inventory (TSI) is designed to:

- introduce you to the **blocks** (*learning categories*), the **tasks** (*learning outcomes*), and **sub-tasks** (*learning objectives*) in the National Occupational Analysis (NOA).

These three sections of the NOA are used in provinces and territories to create an Apprenticeship Logbook. The logbook is used by apprentices and journeypersons to record and sign off technical skill areas learned on the job.

- help you **think about** your technical skills, then help you **list** what you know and can do;
- help you **know what technical skills to focus** on as you go through both your **school training** and while you are working under the **direction of a journeyperson**
- help you make a **technical skills learning plan** to highlight your technical skills learning needs
- help you prepare to complete a Professional Skills Record (PSR) **(if needed)** which lists the details and **all** the skill requirements in your trade

Self-Assessment (SE) ratings assigned to interpret and record data are:

- SE 0 – Yes, I did this
- SE 2 – I need to work on this
- SE 3 – Not sure what this means

Through the completion of your TSI, you have indicated you do not have any immediate learning needs in the following block(s):

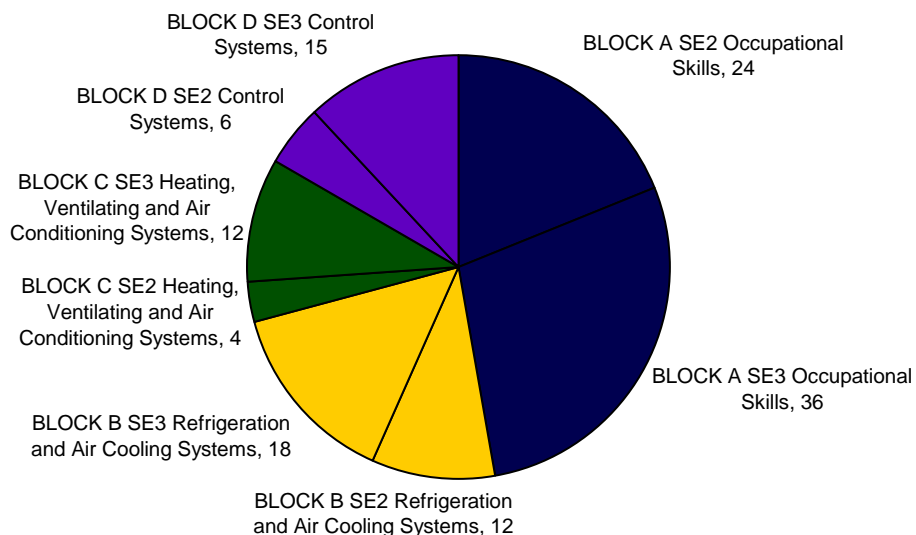
- **Block C - Heating, Ventilating and Air Conditioning Systems**

Individualized Learning Plan

The pie chart represents the learning needs you have identified in your TSI. They are listed from the most need to the least need.

NOTE: Any divided section of the same colour that may occur in your chart highlights where you recorded both SE 2 and SE 3 in the same block.

J. Doe - Individual Learning Plan - Refrigeration and Air Conditioning Mechanic, Montague



■ BLOCK A SE2 Occupational Skills	■ BLOCK A SE3 Occupational Skills
■ BLOCK B SE2 Refrigeration and Air Cooling Systems	■ BLOCK B SE3 Refrigeration and Air Cooling Systems
■ BLOCK C SE2 Heating, Ventilating and Air Conditioning Systems	■ BLOCK C SE3 Heating, Ventilating and Air Conditioning Systems
■ BLOCK D SE2 Control Systems	■ BLOCK D SE3 Control Systems

Technical Skills Personal Learning Plan _____ NAME _____

Technical Skills Goal:

Path to reach goal	Yes	No	How will I reach my goal?
Enter an apprenticeship Block Release program			
Enter a 6-week IP exam preparation (technical skills trade refresher) program			
Technical skills self-study			
Other (explain)			

NOTE: To complete an in-depth, detailed self-assessment of technical skills in a trade, a Professional Skills Record (PSR) is available. (A PSR is the self-assessment tool used in a Recognizing Prior Learning (RPL) Assessment Process). Information on this process is available through the Apprenticeship Section through the Department of Innovation and Advanced Learning. This document is designed to be used by an Apprentice in the workplace and must be signed off by a Licensed Journeyman.)

Additional Comments:

Apprentice Signature _____

Date _____

Trade Essentials Signature(s) _____

