



# Getting the Job Done:

## Preparing to Write the Certificate of Qualification Examination in Ontario

### Tools and Tips for

# Plumbers

Revised 2019



**SUPPORTING  
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COMPLETIONS**

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## Introduction

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### To the Certificate of Qualification Test-taker:

Congratulations on completing your in-school and on-the-job training needed to write the Certificate of Qualification (C of Q exam) in Ontario. This is a major accomplishment! There is just one final step to joining the ranks of Ontario's journeypersons: writing and passing the C of Q exam.

This booklet will give you some advice about these topics related to the C of Q exam:

- Where to find information about the C of Q exam process
- How to study
- What to study
- How to handle test-jitters
- How to tackle a long, multiple choice exam
- Refreshing your trade-related math skills.

The booklet is divided into five sections:

- Registering for the Certificate of Qualification Exam
- Studying and Organizing your Study Materials
- Refreshing your Math Skills
- Test-taking Tips
- Exam Readiness Checklist and Additional Resources

If you are interested in accessing a free adult upgrading program to assist you with some of the material in this booklet, visit [Find Employment and Training in Ontario](#)

### Downloading and Printing

This document is available to download, free of charge, at [www.northernliteracy.ca](http://www.northernliteracy.ca)  
It does not need to be printed in colour.

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### To the Instructor (if applicable)

This booklet can be used for either self-study or in a group setting. For Literacy and Basic Skills (LBS) practitioners who may use this in their programs, it should be noted that the content links primarily to the following OALCF competencies and task groups:

Competency	Task Group	Indicator
Find and Use Information	Read continuous text	A1.3
	Interpret somewhat complex documents to connect, evaluate, and integrate information	A2.2
Understand and Use Numbers	Use measures to make multi-step calculations	C3.3
Manage Learning	n/a	E3

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# Section 1

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## Registering for the Certificate of Qualification Exam

## Important Information!

### Changes to the Skilled Trades and Apprenticeship System in Ontario

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In November 2018, the Ontario government passed the *Making Ontario Open for Business Act*, which resulted in some changes to the apprenticeship and skilled trades system in Ontario:

- One change was the “wind-down” of the Ontario College of Trades (OCoT), which is to be replaced with a new model for regulating Ontario’s skilled trades and apprenticeship training programs in 2019.
- Other changes to the apprenticeship system took effect immediately.
- You can read a summary of the changes in the [joint message](#) from the OCoT and the Ontario Ministry of Training, Colleges, and Universities (MTCU).

**Please note also that this C of Q exam guide was updated in January 2019, and the links to the OCoT website and resources were still active at that time. Further updates to this guide will be needed once the new model for regulating skilled trades and apprenticeship in Ontario is implemented.**

## Background and C of Q Preparation Courses

You probably already know that the C of Q exam is based on material studied in all levels of your apprenticeship training and focuses on practical situations you encounter on the job.

Here is a general list\* of what you'll be tested on:

1. Your understanding of trade terminology and concepts.
2. Your knowledge of the timing and order of tasks.
3. Your knowledge of the reason for performing tasks.
4. Your knowledge of how to perform each task.
5. Your knowledge of standards and permissions for your trade.
6. Your understanding of consequences for each task.

\*Source: [Trade Exams in Ontario Exam Preparation Guide](#), OCoT, 2016

Understanding the theory of your trade and having the on-the-job skills are essential but not enough. You also need to think about how you're going to study and what it will be like to write a multiple choice exam with somewhere between 90 and 150 questions (depending on the trade).

In many cities, C of Q preparation courses are offered for various trades. Frequently, these preparation courses are added as an additional week to the final in-school training session. If you have access to a C of Q prep course, it is a really good idea to register for it, especially if you finished your in-school training some time ago. Contact your local MTCU apprenticeship office, trade union, or public college to find out about prep courses in your area.

If you can't participate in a prep course, this booklet will help you with ideas and strategies for preparing but remember that **it doesn't review trade theory or content related to your trade.**

### Things to Remember

- Trade theory and work experience are the most important topics covered in the exam.
- Enroll in a C of Q preparation course if one is available in your community.
- Read this workbook carefully and practice the suggested activities.
- The better prepared you are the more confident you will be on exam day!

## Scheduling Your Exam

**(Note:** at the time that this guide was updated (January 2019), the processes outlined below were posted on the [Ontario College of Trades](#) website. If you are not able to access the OCoT website, please contact your local MTCU apprenticeship office [on this list](#) for further information.)

The College of Trades is responsible for the content of the C of Q exams. The Ministry of Training, Colleges and Universities (MTCU) is responsible for the scheduling of exams at test centres across the province. Passing the exam lets you receive a C of Q in your trade and join the Journeyperson's class of members with OCoT. If your trade is designated as Red Seal, you will be writing the Red Seal examination, which will lead to a C of Q with an Interprovincial Red Seal endorsement.

You are eligible to write the C of Q exam for your trade if:

- You have a Certificate of Apprenticeship for your trade; or
- You have applied for the Journeypersons' Class and your Trade Equivalency Assessment application has been approved.

### **There are three steps you need to complete to schedule your exam:**

1. Confirm that you're eligible to write the C of Q exam by contacting the College of Trades
2. Contact Client Services at the College of Trades to pay your exam fee (\$150.00 plus HST) at 647 847-3000 or Toll-Free at 1 855 299-0028. Payment can be made by phone (credit card only) or in person (debit, credit card or cheque). Note that fees are subject to change.
3. Contact your local MTCU apprenticeship office [on this list](#). You will require proof of payment to the College when scheduling your exam with the MTCU office.

**Make sure to put your receipt in a safe place as you will need to present it along with valid identification in order to write the exam.**

### **For More Information About the C of Q Exam Process**

You will find a lot of excellent information [here](#) on the 'Resources' page of the OCoT website.

It is also a really good idea to download and read OCoT's [Trade Exams in Ontario Exam Preparation Guide](#). Some of the information in that guide includes:

- **Trade-Related Exam Prep Materials**

- Resources for Red Seal Trades
- Apprenticeship Training Standard Log Book
- Exam Plans for Provincial Certification Exams
- Preparation Courses
- Sample Questions and Tests
- Other Resources (Textbooks, Code Books, Health and Safety)

- **Other Materials**

- General Tips for Studying
- Exam Day: What to Know
- Requests for Accommodation
- Exam Results
- Rewrites

## **Section 2**

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# **Studying and Organizing Your Study Materials**

## Getting Started

If you talk to your boss, your co-workers, other apprentices or journeypersons, you have probably heard that it can be hard to pass the Certificate of Qualification exam. You might know friends or coworkers who have tried and failed the C of Q more than once. You might wonder how to go about prepping to write *and pass* the exam. That is probably why you are reading this booklet!

This section is a combination of resources, tips, and suggestions. As mentioned in Section 1 of this guide, you'll want to check out the [Trade Exams in Ontario Exam Preparation Guide](#) available on the OCoT website. Reading both the Trade Exams in Ontario guide as well as this booklet will answer a lot of the questions you might have.

There are no short cuts to knowing your trade and being thoroughly prepared for the exam. One of the best ways to prepare is to take a C of Q prep course in your trade. To find out more about prep courses that are available in your area, contact your local public college or apprenticeship office.

Remember, this booklet can give you information about how to study and how to tackle the actual exam, **but you still need to study all of the material you learned in all of your in-school training**, and that's where the C of Q prep course comes in. If there isn't a prep course in your area, there are also some websites where you can access C of Q practice questions. (See the "Additional Resources" list at the end of this booklet.)

Think about your favourite athletes. How do you think they prepare for a big game? They train, eat properly, rest, and generally prepare physically, mentally and emotionally in the months, weeks, and days leading up to the event. Your C of Q is like their big game. **Preparing for the exam is not going to happen with a few hours of reading the night before you write.**

- You need to plan in advance and follow through on the best ways available to help you to prepare.
- Take a C of Q prep course if you can.
- Use websites designed to help you study. (See Section 4 for resources.)
- Get advice from your co-workers and instructors.
- Take care of yourself.
- Keep a positive attitude.
- Visualize success.

Are you up for the challenge? Read on to find out more about getting ready for the C of Q exam.

**Pro Tip #1:**

Did you know that with prior approval you have access to the following supports when writing your exam? If any of them apply to you, be sure to let MTCU know when you are scheduling your exam. (Medical notes or other documentation may be required to support your request.)

- Using an interpreter or reader.
- Writing the exam in a separate room to reduce distractions.
- Having extra time to complete the exam.

The translator/interpreter/reader must be a resident of Ontario; they must have a valid Social Insurance card and photo identification such as a driver's license or passport; they must not be in the trade or any trade related to the exam being translated/read. All of the above information and more on the exam scheduling process is available [here](#) on the OCoT website.

## Preparing

### What can I expect to see on the exam?

The majority of the C of Q exam will test you on the practical skills you've learned on-the-job. The exam questions are in multiple choice format with four options from which to choose. Questions test the skills and knowledge identified in the Apprenticeship Training Standard (ATS) and National Occupational Analysis (NOA) for your trade.

Red Seal exams are based more on the NOA, so that is where you may want to focus your studies. See page 19 in this booklet for additional information and web links for the NOA.

### What kind of questions will be asked?

1. Questions testing trade terminology and concepts.
2. Questions asking **when** a specific task should be done. Multiple choice answers could be timeframes such as "every three months" or "after this other task" or "before that task".

3. Questions asking **why** a task is done. Multiple choice answers could be “because this condition exists” or “to get this sort of result”.
4. Questions asking **how** tasks are done; multiple choice answers could be skills and techniques or a certain job sequence.
5. Questions asking **what permission** is needed or **what standard** must be followed in doing a job, e.g., which code or blueprint information is used?
6. Questions asking **consequences**, such as “when a certain event happens or a certain task is done, what effect will it have?”

**Pro Tip #2:**

Your exam may have between 90 and 150 questions! What does this mean?

- You will have up to four hours to write.
- You need 70% to pass.
- If you have 150 questions, you have 240 minutes or 1.6 minutes per question.
- You need to get 105 correct to pass with 70%.

## Collecting Materials for Studying

There are several ways to check your readiness to successfully write the C of Q, and there are many resources available in Ontario to help you prepare. These resources include preparation courses, study guides like this one, sample exam questions, code books, materials and texts. You can also use your own network of support by speaking to your boss, your previous instructors and your co-workers, especially those who have written the C of Q.

### Textbooks

Using the texts and Code books (if applicable) that you’ve accumulated is an important part of preparing for the C of Q. Make sure you have them readily available.

## National Occupational Analysis

Another way to figure out if you're ready to write your Red Seal exam is to look closely at the National Occupational Analysis for your trade. The Red Seal National Occupational Analysis (NOA) is a document that lists all the tasks performed in the occupation and describes the knowledge, skills and abilities required to demonstrate competence in the trade.

NOAs for Red Seal trades provide the content on which Red Seal exam questions are based. Exam questions are written to test your knowledge and competency related to the **sub-tasks** in the NOA. The NOA for your trade is the most important resource and a great tool to help you plan what and how to study for the Red Seal exam.

### Important:

Although the most recent versions of all NOAs are available online [at this site](#), your exam might be based on a previous version of the NOA. Be sure to use the correct NOA for your exam.

Go to [Red Seal Exam Prep](#) site for a thorough guide on how to use the NOA for your trade to prepare for your exam.

## How do I make a plan for studying?

The first thing you need to get started is an action or study plan. A study plan is an organized schedule that outlines study times and learning goals. Creating a study plan can help you concentrate, retain material and effectively manage your time. Schedules will vary for each individual.

You are probably asking yourself, "How much should I study?" There is one way to answer that question. First, gather together all of the resources you have on hand, such as textbooks, notes and handouts from your in-school classes, Code books and the National Occupational Analysis for your trade. This will give you an idea of how much material you'll have to review to prepare for your exam.

Remember, you don't just need to read these materials, you need **to understand** them – you need to be familiar with the material and be able to recall at least 70% of the information during the exam. You will probably have to review your study materials more than once. Now, considering how much material you have to study, fill in the following check list to help you plan your study activities.

(a) Estimate how many hours you think it will take you to become familiar with all of the information you want to learn. \_\_\_\_\_

(b) How many days per week can you study? \_\_\_\_\_

(c) How many hours at a time can you study? \_\_\_\_\_

(d) Considering both (b) and (c), how many weeks do you think it will take you to complete your studying activities? \_\_\_\_\_

### Sample Calculation:

- a) I estimate 50 hours of studying (50 hrs x 60 min/hr = 3,000 min)
- b) I can study 5 days per week.
- c) I can study for 120 minutes per day.
- d) I need  $3,000 \text{ min} / 120 \text{ min per day} / 5 \text{ days per week} = 5 \text{ weeks}$

Your answer to (d) will give you an idea of how long it is going to take you to complete your studies. It will also help you to decide how much time each week you must set aside for studying. Keep in mind, your answer to (a) is an estimate, but you need to stick to a study schedule that allows you to be prepared for the test date if you've scheduled it ahead of time.

### Tips for Creating Your Study Schedule

- Assess your current schedule – try to create a healthy balance between your work life, study life, social life and sleep time.
- Establish a regular studying routine.
- Look at your calendar/planner and flag study and non-study days.
- Schedule study sessions in blocks – short blocks can be easier to schedule and more effective. There is a sample planner on the next page.
- List all the subjects you need to study and rank them by deciding which are most important and which you think need the most reviewing.
- Do your most difficult studying when you feel best. Are you a morning person or a night owl?
- Make up a specific schedule and reward yourself when you stick to it, e.g. three nights a week, I will study for one hour after the kids are in bed, and then I can watch my favourite show.

## Sample Study Schedule

Use this planner (or one like it) to map out a study schedule that is realistic for your work and family commitments.

Time	Week of _____	Week of _____	Week of _____	Notes
5:00 a.m.				
6:00 a.m.				
7:00 a.m.				
8:00 a.m.,				
9:00 a.m.				
10:00 a.m.				
11:00 a.m.				
12:00 p.m.				
1:00 p.m.				
2:00 p.m.				
3:00 p.m.				
4:00 p.m.				
5:00 p.m.				
6:00 p.m.				
7:00 p.m.				
8:00 p.m.				
9:00 p.m.				
10:00 p.m. -				
11:00 p.m.				
<b>Notes</b>				

## Study Strategies

### Tips to Remember

Approach your exam preparation as you would any complex, on-the-job task:

- Get a good idea of the scope of the job. (How much material do I need to review? How many hours will this take?)
- Develop a plan of attack.
- Assemble your tools (notes, Code book, textbooks).
- Use the NOA to help you break the material you need to study into manageable pieces in a logical order.
- Talk to others who have experience. Your supervisor or foreman may be able to provide you with some study materials and/or give you on-the-job assignments that will refresh your skills and knowledge.
- Regularly review your progress.
- Take breaks as you complete each section. (Reward yourself!)
- If you become frustrated, take a break, step back and reconsider your strategy.
- Make sure you understand the specific task or concept. Often, explaining it to others helps you to file it away in your memory.
- Draw pictures, talk out loud to yourself or others to reinforce your understanding.
- Show up for studying rested, focused and ready to work.
- Don't be too hard on yourself! Like any complex job it takes time and there may be wrong turns and dead ends along the way. But the job gets done!

### How do I learn best?

Do you know your learning style? A learning style is the way in which you best learn new things. You may learn best by seeing, listening, or doing. If you know your learning style, this may help you with your studying as you can use strategies that best suit your particular style. For example, if you learn best by seeing, you may want to have flash cards with questions and answers about key information that you want to learn.

Here is a short explanation of these three learning styles:

- a) **Visual learners** learn best by seeing pictures, graphs, charts, diagrams, etc. that represent ideas
- b) **Auditory learners** learn best by listening to discussions, lectures, tapes, etc.
- c) **Tactile learners** (sometimes called “hands-on” learners) learn best by doing things like handling equipment, watching other people do things, etc.

Many skilled trades workers are hands-on (tactile) learners, which is why they are so good at their trade!

Check out [this website](#) to find out what your learning style is. You will also find some tips on how to best learn new material, according to your particular learning style

**Pro Tip #3:**

Keep in mind that a lot of people learn in more than one of those three ways: visual, auditory, and tactile.

### How will I remember everything?

Work at **understanding** the material, not just memorizing it. Remember, you have to do two things:

- you need to *learn* the material, and
- you also need to *retain* the material.

For example, if a math teacher explains to you how to do a certain question, you are probably able to figure it out in that moment and do a question or two on your own.

However, if you were to sit down three days later by yourself, would you be able to complete the same type of questions on your own? That would depend on whether or not you’ve *retained* the information.

You have to really **understand** your trade in order to successfully pass the C of Q, not just rely on memorization. However, there are a few suggestions you may want to use to help you file critical information in your long-term memory.

- **Don't try to learn too much at once.** Break down topics for study into six or seven items; review and memorize these items. Take a short break to give your memory time to store the new information.
- **Use short study periods with regular breaks.** You will learn faster and remember longer if you study in several short sessions rather than in one long session. Do not attempt to study for an entire weekend. It is wiser to spend some time each day rather than to try to cram your work into a few days.
- **Write down what you are learning.** Get into the habit of writing down key ideas as you read. This will help you to visualize the answers when you are writing the exam. The more senses you use while you study, the more effective the learning will be. For example, you can write down key points and repeat these points out loud to yourself.
- **Don't try to study in a room with television or other distractions.** This will make it more difficult for you to commit your materials to memory.
- **Work with a partner or in a small group.** Ask each other questions. If you don't have another apprentice to work with, you can ask a friend or family member to quiz you (verbally) on items like lists, sets of steps, etc.
- **Ask yourself questions.** If you're working alone, ask yourself questions and/or want to repeat information verbally as you read it.
- **Use a stress ball while you study if that's helpful.** You may also find it helpful to chew gum, have a bottle of water with you, or other things to make you comfortable and better able to concentrate.

### **How can I make the best use of my texts and reference books?**

From the OCoT website, here are some suggestions:

- Find a good glossary of terms (often found in text books).
- Identify important or typical problems in the trade performances.
- Identify exceptions to theories and the conditions where they occur.
- For each concept, find and learn the related definitions or formulas.
- Relate each concept or formula to your work experience.
- Relate the concepts to one another to create a general overview.
- Sequence or organize information according to on-the-job activities so that it makes sense.
- Rehearse sequences and relationships by repeating them out loud.
- Draw diagrams to show structures and relationships.

## Using Memory Aids

You're probably already familiar with some memory aids. On the next few pages are some examples of memory aids that may be helpful.

### a) Acronyms

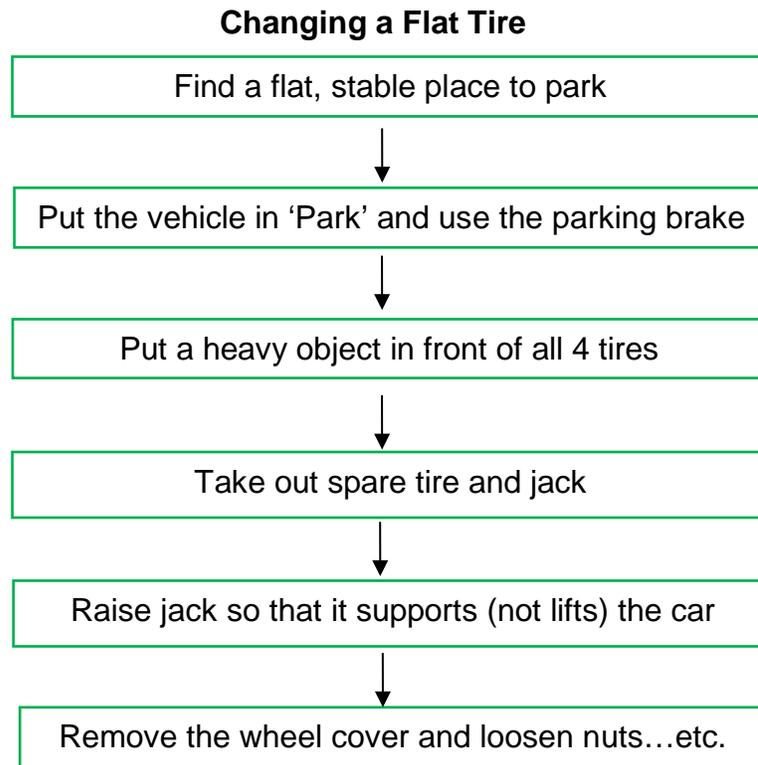
One way of memorizing material is to create an acronym. An acronym uses the first letters of a series of words to make another word. An acronym that you may be familiar with is WHMIS:

**W**orkplace  
**H**azardous  
**M**aterials  
**I**nformation  
**S**ystem

You can use the first letters of a cluster of words to make an acronym which will help you remember processes or procedures.

### b) Flow Charts

When you have a process or set of steps to memorize, a flow chart can be useful. Check out the simplified example below for the first few steps of changing a flat tire.



### c) Point-form Notes

Another way to help memorize longer materials from text books or manuals is to make short form or point-form notes. Point-form notes list brief but important details needed for understanding the topic. Use headings to separate topics. Use bullet points with simple words or phrases to note the details.

Look at the passage below from the Government of Canada Red Seal website.

*The Interprovincial Standards Red Seal Program was established to provide greater mobility for skilled workers across Canada. The Red Seal program allows qualified tradespeople to practice their trade anywhere in Canada where the trade is designated without having to write further examinations. To date, over 50 trades are included in the Red Seal program, accounting for almost 90% of all apprentices and more than 80% of the total trades workforce in Canada. More information about the Red Seal program, including a list of the designated Red Seal trades in Canada, is available at [www.red-seal.ca](http://www.red-seal.ca).*

Now, look at how this paragraph could be written using point-form notes:

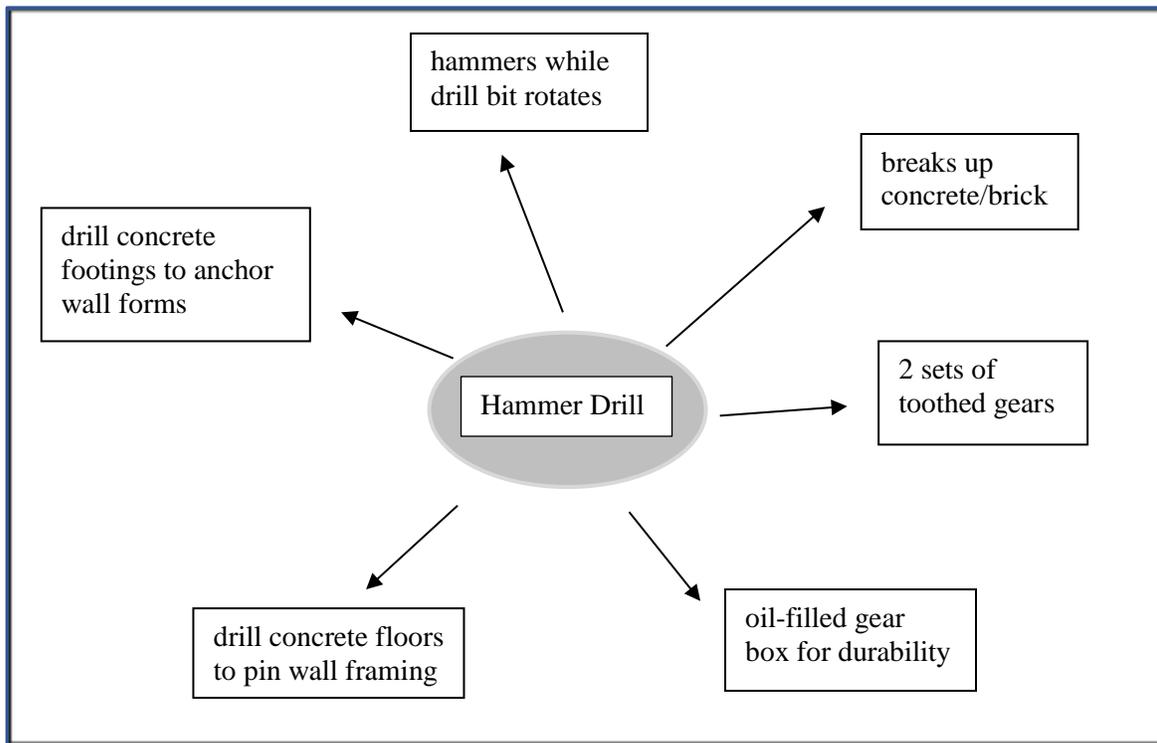
- *Red Seal lets you work anywhere in Canada if qualified*
- *No extra exams needed*
- *50 Red Seal trades*
- *90% of all apprentices*
- *80% of trades workers in Canada*
- *More info at website*

As well as making point-form notes, here are a few related suggestions:

- Create your own short forms to save time, e.g. “because” might become “b/c”; and “between” might become “btwn”.
- Highlight important sections or points in your materials.
- Make notes in the margins of your books as well to draw your attention to important or difficult concepts.
- Write out your own summary notes to combine all the sources you have reviewed: books, notes, conversations with teachers and coworkers, etc.
- Use colour, diagrams, numbers, and symbols to help you organize the material and make it easier to remember.

### d) Mind Maps

Another thing you may want to do to assist your memory is to create a mind-map. Mind maps can help with memorizing, learning, and problem solving. Use a blank piece of paper to draw the mind map. Put one word or term in the middle, and draw lines to other words or short facts that are related to that central term. Below is a simplified example related to a hammer drill.



When you're trying to memorize material, use colours, shapes, highlights— whatever will help you remember/visualize the information that you need to remember.

Finally, repetition is important! You will remember more information if you repeat it out loud, in your head, or write it down on paper.

## Additional Study Tips: True or False?

Decide whether the following statements are true or false. Answers are below.

1. T/F \_\_\_ Always study in a very warm room.
2. T/F \_\_\_ Never eat or drink before you begin studying.
3. T/F \_\_\_ Try to predict test questions. For example, review the NOA for your trade and try to anticipate what questions might be asked. Put yourself in the shoes of the exam writer and say, "If I wanted to test someone on this topic, what would I ask?"
4. T/F \_\_\_ Assign yourself study time for a topic based on its importance, i.e. don't spend a large percentage of your study time on things that likely won't be on the exam).
5. T/F \_\_\_ If you have written the exam before, look at your exam letter and identify which areas you were weaker in and focus on those areas.
6. T/F \_\_\_ Do not set an alarm on your phone to remind you when to begin studying, and when to stop!

Answers:	1. F	2. F	3. T	4. T	5. T	6. F
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### Pro Tip #4

Effective study begins well before the exam and depends on spreading out your study times. Your ability to remember the material will be greatly improved if you look at your study materials often and re-read them frequently.

## **Section 3**

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# **Refreshing Your Math Skills**

## Instructions

This section includes 30 math-related problems that review material in all levels of your in-school training. **This is not the only review you'll need to do**, but it does give you a sample of multiple choice questions that might be similar to what you would see on the C of Q exam.

You will have learned the theory and concepts during your in-school training. This brief review will not teach you the concepts. It will help you apply the theory you have already learned.

### Instructions:

1. Complete the problems, either right on these pages or on separate paper.
2. Conversions and formulas are on pages 37 and 38.
3. Check your answers with the **Answer Key** on page 39.
4. Review the **Solutions** (pages 40 to 46) and highlight areas where your solutions differ so that you can go back and re-work the problem.
5. You need to get 21 out of 30 correct to achieve 70%.

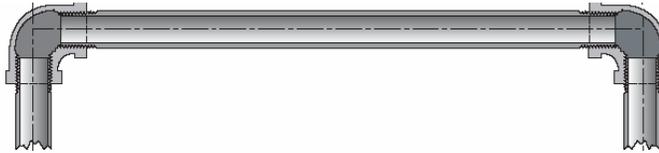
## Problem Set: Plumbers

**Note:** Conversions and Formulas are on pages 37 and 38.  
Answer Key is on page 39; full solutions are on pages 40 to 46.

- 1) Jim has a  $12\frac{3}{4}$ " piece of copper pipe. He needs to cut the pipe so that he has a 4" and  $3\frac{1}{16}$ " piece. Jim loses  $\frac{1}{8}$ " for every cut that he makes. How much of the copper pipe remains after Jim cuts the pipe?
- $5\frac{2}{3}$ "
  - $4\frac{1}{3}$ "
  - $5\frac{7}{16}$ "
  - $5\frac{1}{8}$ "
- 2) The outside radius of a pipe is 6.75 mm, and the inside radius of the pipe is 5.93 mm. Determine the thickness of the pipe.
- 0.82 mm
  - 12.68 mm
  - 1.14 mm
  - 0.88 mm
- 3) A pipe measuring  $1\frac{1}{8}$ " in diameter requires to be converted to metric units. What is the diameter of this pipe in millimetres (mm)?
- 45.72 mm
  - 1.125 mm
  - 28.575 mm
  - 29.972 mm
- 4) Candice is provided with some building drawings, and she notes that a drain has an elevation of 26.26' at one point and an elevation of 19.09' at a second point. Determine the fall on this horizontal drainage pipe in feet and inches.
- 7'2"
  - $7'2\frac{1}{16}$ "
  - 9'2"
  - 9'1"

- 5) Determine the end to end measurement of a pipe that has a centre to centre measurement of 4'6", keeping in mind the total fitting allowance for two 90° elbows.

Note that the pipe has a nominal pipe size of  $1\frac{1}{4}$ ".



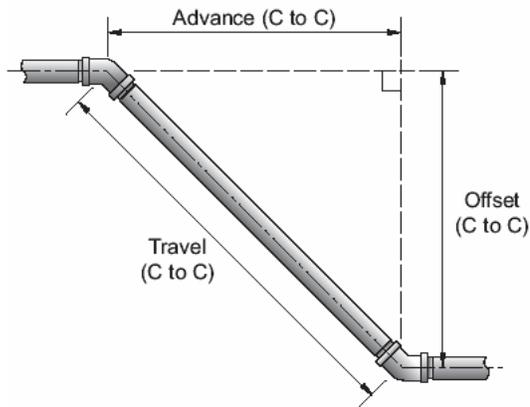
Nominal Pipe Size (inches)	Fitting Allowance Dimension (inches) "A"		Thread Engagement Dimension (inches) "B"		
	90° Elbow & Tee	45° Elbow			
1/4"	1/2"	12	7/16"	3/8"	8
3/8"	5/8"	15	7/16"	3/8"	8
1/2"	11/16"	17	7/16"	1/2"	12
3/4"	13/16"	19	1/2"	9/16"	14
1"	15/16"	21	9/16"	11/16"	17
1 1/4"	1 1/8"	30	11/16"	11/16"	17
1 1/2"	1 5/16"	37	13/16"	11/16"	17
2"	1 9/16"	41	1"	3/4"	18

Thread Engagement and Grinnell™ Fitting Allowance Data for Cast Iron Elbows and Tees

Given: **End-to-end measurement of pipe** = **Centre to centre measurement** - **Total fitting allowance**

- a.  $4'4\frac{5}{8}"$
- b.  $4'3\frac{3}{4}"$
- c. 4'3"
- d. 4'4"

- 6) Given the pipe below with 45° fittings, determine the offset if the advance is 25".



- a. 50"  
 b. 12.5"  
 c. 25"  
 d. 37.5"
- 7) Given the pipe in question six, calculate the offset of a pipe with 45° fittings. The travel of the pipe centre to centre is 16". State the final answer in sixteenths of an inch.

Given: **Travel = Offset × 1.414**

- a. 11.3"  
 b.  $11 \frac{5}{16}$ "  
 c.  $11 \frac{3}{8}$ "  
 d.  $11 \frac{7}{16}$ "
- 8) Calculate the surface area of a cylindrical tank, with an open top, that requires painting. The height of the tank is 5 metres, with a diameter of 0.8 metres.

Given: **Surface Area =  $\pi dh + \pi r^2$**

- a. 2.01 m<sup>2</sup>  
 b. 14.57 m<sup>2</sup>  
 c. 13.06 m<sup>2</sup>  
 d. 12.56 m<sup>2</sup>

- 9) Determine the volume of a spherical tank knowing that the diameter is 8.5 m.

$$\text{Volume} = \frac{4}{3} \pi r^3$$

- a. 321.29 m<sup>3</sup>  
b. 76.77 m<sup>3</sup>  
c. 12.46 m<sup>3</sup>  
d. 245.67 m<sup>3</sup>
- 10) Water is flowing at a rate of 309 gallons/minute through an industrial distribution pipe system. If this flow is to be reduced by 35%, what is the new rate of flow for this system?
- a. 108.15 gallons/minute  
b. 11.33 gallons/minute  
c. 210.36 gallons/minute  
d. 200.85 gallons/minute
- 11) A rectangular tank can be filled by four pipes in 90 minutes. How long would it take for the same tank to be filled by six pipes?
- a. 120 minutes  
b. 60 minutes  
c. 90 minutes  
d. 30 minutes

- 12) Determine the quantity of heat (BTU's) required to heat 26 pounds of water from 32°F to 200°F?

$$Q = S_H m \Delta T$$

Where: Q = quantity of heat (BTU's)  
 $S_H$  = specific heat  
 m = mass (lb.)  
 $\Delta T$  = change in temperature (°F)

Specific Heats	
Hydrogen	3.4
Liquid Ammonia	1.25
Water	1.0
Alcohol	0.602
Ice	0.53
Ammonia	0.52
Steam	0.48
Air	0.24
Aluminum	0.22
Carbon Dioxide	0.24
Glass	0.197
Cast Iron	0.119

- a. 4368 BTU's
- b. 6883 BTU's
- c. 832 BTU's
- d. 1259 BTU's

13) Using the formula and specific heats given in questions 12, calculate the quantity of heat (BTU's) required to raise the temperature of 52 kilograms of water by 102°F.

- a. 5304.3 BTU's
- b. 11 683.08 BTU's
- c. 10 549.7 BTU's
- d. 11 464.16 BTU's

14) Calculate the quantity of heat required to change 20 pounds of ice at 12°F to 20 pounds of water at 176°F.

	<b><math>Q = m (t_2 - t_1)S_{H1} + m (\text{LHF}) + m (t_2 - t_1)S_{H2}</math></b>
Where:	Q = quantity of heat (BTU's)
	m = mass (lb)
	( $t_2 - t_1$ ) = change in temperature (°F)
	LHF = latent heat of fusion (144 BTU's/pound)

- a. 5972 BTU's
- b. 6549 BTU's
- c. 10 365 BTU's
- d. 5812 BTU's

15) A quantity of heat is added to 15 pounds of water at 120°F. Determine this quantity of heat to change the water to 15 pounds of steam at 212°F.

	<b><math>Q = m (t_2 - t_1)S_{H1} + m (\text{LHV}) + m (t_2 - t_1)S_{H2}</math></b>
Where:	Q = quantity of heat (BTU's)
	m = mass (lb)
	( $t_2 - t_1$ ) = change in temperature (°F)
	LHV = latent heat of vaporization (970 BTU's/pound)

- a. 18 245 BTU's
- b. 17 166 BTU's
- c. 15 930 BTU's
- d. 9 448 BTU's

16) Calculate the length of a pipe that has fall of 2.67' and a grade of 2.87%.

$$\text{Total fall} = \text{Length} \times \text{Grade}$$

- a. 0.93'
- b. 7.66'
- c. 93.03'
- d. 64.99'

17) A 90° elbow has a list price of \$4.43. If the trade discount is 20%, what is the net price?

- a. \$3.54
- b. \$4.21
- c. \$0.89
- d. \$4.25

18) What is the amount of water, in gallons, a cylindrical tank can hold given that the tank has a height of 3.52 metres and diameter of 1.02 metres?

$$\text{Volume} = \pi r^2 h$$

- a. 3002 gallons
- b. 633.41 gallons
- c. 220.70 gallons
- d. 76.90 gallons

- 19) Determine the increase in length for a 20 foot copper pipe that changes temperature from 45°F to 100°F. (See Thermal Expansion Coefficients on the next page.)

**Linear expansion = length (in) × coefficient of linear expansion × temperature change (°F)**

### Thermal Expansion Coefficients

Material	Fractional expansion per degree °F
Glass, ordinary	0.000005
Glass, pyrex	0.0000022
Quartz, fused	0.00000033
Aluminum	0.000013
Brass	0.000011
Copper	0.0000093
Iron	0.0000067
Steel	0.0000072
Platinum	0.000005
Tungsten	0.0000024
Gold	0.0000078
Silver	0.000010

Source: <http://hyperphysics.phy-astr.gsu.edu/hbase/tables/thexp.html>

- a. 0.133"
- b. 0.010"
- c. 0.123"
- d. 1.22"

- 20) Convert the linear expansion of the copper pipe in question 19 to sixteenths of an inch.

- a.  $\frac{1}{8}$  "
- b.  $\frac{1}{16}$  "
- c.  $\frac{1}{4}$  "
- d.  $\frac{3}{16}$  "

- 21) A pre-charged cylindrical pressure tank has a diameter of 22" and a height of 72". Calculate the volume of the tank in gallons.

$$\text{Volume} = \pi r^2 h$$

- a. 5700.23 gallons  
 b. 100.21 gallons  
 c. 121.1 gallons  
 d. 98.81 gallons
- 22) The cylindrical tank in question 21 is installed in a hydropneumatic water system operating at 20-40PSI. Calculate the discharge of water in gallons that the tank will deliver as the pressure changes from 40 PSI to 20 PSI.

$$\text{Discharge} = \text{Tank Capacity Start Range} - \text{Tank Capacity End Range}$$

$$\text{Given: Tank Capacity Start Range} = \frac{(14.7 + 2\text{PSI below start range}) \times \text{Tank Volume}}{14.7 + \text{Start Range}}$$

$$\text{Tank Capacity End Range} = \frac{(14.7 + 2\text{PSI below start range}) \times \text{Tank Volume}}{14.7 + \text{End Range}}$$

- a. 36.13 gallons  
 b. 34.05 gallons  
 c. 36.04 gallons  
 d. 17.38 gallons
- 23) The discharge from a cylindrical pressure tank is determined to be 523 Imperial gallons. What is the discharge of this tank in litres?
- a. 1673.6 litres  
 b. 2405.8 litres  
 c. 11 369.6 litres  
 d. 2500 litres

24) Calculate the pressure of water in a 2-inch vertical pipe that is 48 feet high.

$$\text{PSI} = \text{head in feet} \times 0.434 \text{ PSI}$$

- a. 20.83 PSI
- b. 41.66 PSI
- c. 21.00 PSI
- d. 110.56 PSI

25) The PSI of a 2-inch vertical pipe is determined to be 50.98 PSI. Convert this pressure of water to kPa.

- a. 7.4 kPa
- b. 349.2 kPa
- c. 357 kPa
- d. 54.7 kPa

26) Determine the total force for a 2" vertical pipe that has a height of 72'.

$$\text{Total force} = \text{base area (in}^2\text{)} \times \text{pressure (PSI)}$$

- a. 95.92 pounds
- b. 31.41 pounds
- c. 372.24 pounds
- d. 98.12 pounds

27) Calculate the total weight of a rectangular tank with a length of 10', width of 7'6" and height of 2'2".

$$\text{Total force} = \text{volume (ft}^3\text{)} \times 62.5 \text{ pounds/ft}^3$$

- a. 10 157.81 pounds
- b. 12 743.22 pounds
- c. 4340. 98 pounds
- d. 11 143. 21 pounds

- 28) On average, a person uses 75 gallons of water per day. Knowing this, calculate the capacity of water softener required for a five-person home that has a water hardness value of 8 grains per gallon, and an iron concentration of 2 PPM. Note that this household uses a water softener generation of 5 days.

$$\text{Capacity} = [(\text{persons in household} \times \text{gallons/day}) \times (\text{hardness value} + \text{iron concentration} \times \text{persons in household}) + 20\%] \times \text{days}$$

- a. 50 500 grains
  - b. 40 500 grains
  - c. 33 750 grains
  - d. 6750 grains
- 29) What is the total fall on a building drain that has a developed length of 143 metres and installed at 2% slope?

$$\text{Given: Total fall} = \text{length} \times \text{grade}$$

- a. 7.15 m
  - b. 2.86 m
  - c. 5.22 m
  - d. 3.43 m
- 30) What is the slope of a building drain that has a length of 120' and a total fall of 30'?

$$\text{Given: Total fall} = \text{length} \times \text{grade}$$

- a. ¼" per foot
- b. 4" per foot
- c. ½" per foot
- d. 2" per foot

## Conversions and Formulas

Liters	Equivalents
1 centiliter	10 milliliters
1 deciliter	10 centiliters
1 liter	1000 milliliters
1 liter	100 centiliters
1 liter	10 deciliters
1 liter	1 liter
1 decaliter	10 liters
1 hectoliter	100 liters
1 hectoliter	10 decaliters
1 kiloliter	1000 liters
1 kiloliter	10 hectoliters

Mass	Conversions
1 centigram	10 milligrams
1 decigram	10 centigrams
1 gram	10 decigrams
1 decagram	10 grams
1 hectogram	10 decagrams
1 kilogram	10 hectograms
1 gram	1000 milligrams
1 kilograms	1000 grams

Concentrations	Conversions
1 part per million	1 milligram per litre
1 part per million	0.0584 grains per gallon
1 part per million	8.34 pounds per million gallons
1 grain per gallon	17.1 parts per million Imperial or 14.3 parts per million US
1 grain per gallon	143 pounds per million gallons
1 percent solution	1 part per 100 parts
1 percent solution	10,000 parts per million

Volume and Capacity	Conversions
1 cubic foot	7.48 US gallons
1 ounce	28 grams
1 Imperial gallon	4 quarts = 160 ounces
1 US gallon	120 ounces
1 gallon	8 pints
1 gallon	231 cubic inches US 277 cubic inches Imperial
1 gallon	3.79 liters US 4.6 liters Imperial
1 cubic inch	16.4 cubic centimeters
1 cubic meter	220.7 Imperial gallons

Pressure	Conversions
1 pound per square inch	6.85 Kilopascals
1 pound per square inch	2.31 feet of water, or 28 inches
1 foot of head	0.433 pounds per square inch
1 meter of head	9.6 kilopascals

**Conversion and Formulas (continued)**

<b>Lengths</b>	<b>Equivalents</b>
1/4 inch	.6 centimeters
1 inch	0.0254 meters
1 inch	25.4 millimeters
1 inch	2.54 centimeters
1 foot	12 inches
1 foot	0.306 meters
1 yard	3 feet
1 mile	5280 feet
1 mile	1760 yards
1 mile	5280 feet
1 mile	1.61 kilometers
1 meter	3.28 feet or 39 3/8 inches
1 yard	0.918 metres
1 meter	1000 millimeters
1 meter	100 centimeters
1 meter	10 decimeters
1 meter	1 meter = 39 3/8 inches
1 decameter	10 meters
1 hectometer	100 meters
1 hectometer	10 decameters
1 kilometer	1000 meters = .6214 miles
1 kilometer	10 hectometers
1 centimeter	10 millimeters
1 decimeter	10 centimeters

<b>Weight</b>	<b>Conversions</b>
20 hundred weight	1 Ton (British or Long)
2240 pounds	1 Ton (British or Long)
2000 pounds	1 Ton (US or Short)
2200 pounds	1 Ton (Metric)
1 pound	0.454 kilograms
2.2 pounds	1 kilogram
1 gallon of water	10 pounds Imperial 8.34 pounds US
1 cubic foot of water	62.4 pounds Imperial
Density of water at 4°C	10 pounds per gallon
Density of water at 4°C	62.4 pounds per cubic foot
Specific gravity of water at 4°C	1.0
1 cubic meter of water	220.7 Imperial gallons 2207 pounds

## Answer Key

(For full solutions, see the following pages.)

1. c
2. a
3. c
4. b
5. b
  
6. c
7. b
8. c
9. a
10. d
  
11. b
12. a
13. b
14. a
15. c
  
16. c
17. a
18. b
19. c
20. a
  
21. d
22. b
23. b
24. a
25. b
  
26. d
27. a
28. b
29. b
30. a

# Solutions

Keep in mind that sometimes there is more than one way to find the correct answer and that final answers may vary slightly due to the number of decimal places carried through the calculation. These solutions show one possible method.

## 1) Answer (c)

$$\begin{aligned}
 & 12\frac{3}{4}'' - [4'' + 3\frac{1}{16}'' + 2(\frac{1}{8}'')] \\
 &= 12\frac{3}{4}'' - [4'' + 3\frac{1}{16}'' + \frac{2}{8}''] \\
 &= 12\frac{12}{16}'' - [4'' + 3\frac{1}{16}'' + \frac{4}{16}''] \\
 &= 12\frac{12}{16}'' - 7\frac{5}{16}'' \\
 &= 5\frac{7}{16}''
 \end{aligned}$$

Order of operations states multiplication must occur before subtraction

When adding and subtracting fractions, a common denominator is needed

## 2) Answer (a)

$$\begin{array}{r}
 6.75 \\
 -5.93 \\
 \hline
 0.82
 \end{array}$$

Borrow from the ones' column and give to the tenths' column.

## 3) Answer (c)

$$\begin{aligned}
 1\frac{1}{8}'' &= 1.125'' \\
 \frac{1 \text{ inch}}{25.4 \text{ mm}} &= \frac{1.125 \text{ inches}}{x \text{ mm}} \\
 x &= 28.575 \text{ mm}
 \end{aligned}$$

To convert a fraction to a decimal, divide the numerator by the denominator

## 4) Answer (b)

$$\begin{aligned}
 \text{Total fall} &= 26.76' - 19.09' \\
 &= 7.17' \\
 .17 \times 12 &= 2.04'' \\
 .04 \times 16 &= 0.64 \\
 \text{Total fall} &= 7'2\frac{1}{16}''
 \end{aligned}$$

Convert the fraction of a foot to inches by multiplying by 12  
Convert the fraction of an inch to sixteenths by multiplying by 16

5) **Answer (b)**

$$\begin{aligned} \text{Total fitting allowance} &= 2\left(1\frac{1}{8}\text{''}\right) \\ &= 2\left(\frac{9}{8}\text{''}\right) \\ &= \frac{18}{8}\text{''} \\ &= 2\frac{2}{8}\text{''} \\ &= 2\frac{1}{4}\text{''} \end{aligned}$$

To multiply a mixed number, change it to an improper fraction first

End-to-end measurement = Centre to centre measurement – Total fitting allowance

$$\begin{aligned} &= 4'6'' - 2\frac{1}{4}\text{''} \\ &= 4'3\frac{3}{4}\text{''} \end{aligned}$$

6) **Answer (c)**

The other two angles in the triangle are  $45^\circ$ , making the triangle an isosceles triangle. As a result, the two sides (not opposite the right angle) are equal. Therefore, the advance equals the offset, making the offset 25".

7) **Answer (b)**

$$\text{Travel} = \text{Offset} \times 1.414$$

$$16'' = \text{Offset} \times 1.414$$

$$\frac{16''}{1.414} = \text{Offset}$$

$$11.32'' = \text{Offset}$$

$$0.32'' \times 16 = 5.12''$$

$$11\frac{5}{16}'' = \text{Offset}$$

To isolate the offset, both sides of the equation must be divided by 1.414

To convert inches to sixteenths of an inch, multiply the fraction of an inch by 16

8) **Answer (c)**

$$\begin{aligned} \text{Surface area} &= \pi dh + \pi r^2 \\ \text{SA} &= (3.14)(0.8\text{m})(5\text{m}) + (3.14)(0.4\text{m})^2 \\ \text{SA} &= 12.56\text{m}^2 + 0.50\text{m}^2 \\ \text{SA} &= 13.06\text{m}^2 \end{aligned}$$

Because the top of the cylinder is open, the two is removed from the formula

9) **Answer (a)**

$$\text{Volume} = \frac{4}{3} \pi r^3$$

$$\text{Volume} = \frac{4}{3} \pi (4.25 \text{ m})^3$$

$$\text{Volume} = 321.56 \text{ m}^3$$

10) **Answer (d)**

$$\frac{x}{309} = \frac{65}{100}$$

$$x = 200.85 \text{ gallons/minute}$$



The new system will flow at 100%-35% = 65%

11) **Answer (b)**

Number of Pipes		Time
$\frac{4}{6}$	=	$\frac{x}{90}$

$$6x = 360$$

$$x = 60 \text{ minutes}$$

12) **Answer (a)**

$$Q = m \Delta T S_H$$

$$Q = (26 \text{ lb}) (200 - 32^\circ\text{F}) (1.0)$$

$$Q = 4368 \text{ BTU's}$$

13) **Answer (b)**

$$\frac{0.454 \text{ kg}}{1 \text{ lb}} = \frac{52 \text{ kg}}{x \text{ lb}}$$

$$x = 114.54 \text{ lb}$$

$$Q = S_H m \Delta T$$

$$Q = (1.0) (114.54 \text{ lb}) (102^\circ\text{F})$$

$$Q = 11\,683.08 \text{ BTU's}$$

**14) Answer (a)**

$$Q = m (t_1 - t_1) S_1 + m (\text{LHF}) + m (t_1 - t_1) S_{H2}$$

$$Q = 20 \text{ lb } (32 - 12^\circ\text{F}) (0.53) + 20 \text{ lb } (144 \text{ BTU's/pound}) + 20 \text{ lb } (176 - 32^\circ\text{F}) (1.0)$$

$$Q = 212 + 2880 + 2880$$

$$Q = 5972 \text{ BTU's}$$

**15) Answer (c)**

$$Q = m (t_1 - t_1) S_1 + m (\text{LHV}) + m (t_1 - t_1) S_{H2}$$

$$Q = 15 \text{ lb } (212 - 120^\circ\text{F}) (1.0) + 15 \text{ lb } (970 \text{ BTU's/pound}) + 15 \text{ lb } (212 - 212^\circ\text{F}) (0.48)$$

$$Q = 1380 + 14\,550 + 0$$

$$Q = 15\,930 \text{ BTU's}$$

**16) Answer (c)**

$$2.87\% = 0.0287$$

$$\text{Total fall} = \text{Length} \times \text{Grade}$$

$$2.67' = \text{Length} \times 0.0287$$

$$\frac{2.67'}{0.0287} = \text{Length}$$

$$93.03' = \text{Length}$$

The grade percentage must be converted to a decimal first

**17) Answer (a)**

$$\text{Net price} = \text{List price} - \text{Amount of discount}$$

$$\text{Net price} = \$4.43 - (\$4.43 \times 0.20)$$

$$\text{Net price} = \$3.54$$

To determine the amount of discount, multiply the list price by the discount rate converted to a decimal

**18) Answer (b)**

$$\text{Volume} = \pi r^2 h$$

$$\text{Volume} = (3.14) (0.51 \text{ m})^2 (3.52 \text{ m})$$

To determine the radius, divide the diameter by two

(Continued on the next page)

$$\text{Volume} = 2.87 \text{ m}^3$$

$$\frac{1 \text{ m}^3}{220.7 \text{ gallons}} = \frac{2.87 \text{ m}^3}{x \text{ gallons}}$$

$$x = 633.41 \text{ gallons}$$

19) **Answer (c)**

$$\frac{1 \text{ foot}}{12 \text{ inches}} = \frac{20 \text{ feet}}{x \text{ inches}}$$

$$x = 240 \text{ inches}$$

Linear expansion = length (in)  $\times$  coefficient  $\times$  temperature change ( $^{\circ}\text{F}$ )

Linear expansion = (240 inches) (0.0000093) (100-45 $^{\circ}\text{F}$ )

Linear expansion = 0.123"

20) **Answer (a)**

$$0.123 \times 16$$

$$= 1.968$$

$$= \frac{2}{16} \text{ "}$$

$$= \frac{1}{8} \text{ "}$$

Round to the nearest whole number;  
therefore, 1.9 rounds to 2

21) **Answer (d)**

$$\text{Volume} = \pi r^2 h$$

$$\text{Volume} = \pi(11\text{'})^2 (72\text{'})$$

$$\text{Volume} = \pi(121\text{'}) (72\text{'})$$

$$\text{Volume} = 27\,369.56 \text{ in}^3$$

$$\frac{1 \text{ gallon}}{277 \text{ in}^3} = \frac{x \text{ gallons}}{27\,369.56 \text{ in}^3}$$

$$277 \text{ in}^3$$

$$27\,369.56 \text{ in}^3$$

$$x = 98.81 \text{ gallons}$$

**22) Answer (b)**

$$\text{Discharge} = \frac{(14.7 + 2\text{PSI below start range}) \times \text{Tank Volume}}{14.7 + \text{Start Range}}$$

$$\text{Discharge} = \frac{(14.7 + 2\text{PSI below start range}) \times \text{Tank Volume}}{14.7 + \text{End Range}}$$

$$\text{Discharge} = \frac{(14.7 + 18\text{PSI}) \times (98.81 \text{ gallons})}{14.7 + 20\text{PSI}} - \frac{(14.7 + 18\text{PSI}) \times (98.81 \text{ gallons})}{14.7 + 40\text{PSI}}$$

$$\text{Discharge} = \frac{(32.7)(98.81 \text{ gallons})}{34.7} - \frac{(32.7)(98.81 \text{ gallons})}{54.7}$$

$$\text{Discharge} = 93.115 \text{ gallons} - 59.069 \text{ gallons}$$

$$\text{Discharge} = 34.05 \text{ gallons}$$

**23) Answer (b)**

$$\frac{1 \text{ gallon}}{4.6 \text{ litres}} = \frac{523 \text{ gallons}}{x \text{ litres}}$$

$$x = 2405.8 \text{ litres}$$

**24) Answer (a)**

$$\text{PSI} = \text{head in feet} \times 0.434 \text{ PSI}$$

$$\text{PSI} = 48' \times 0.434 \text{ PSI}$$

$$\text{PSI} = 20.83 \text{ PSI}$$

**25) Answer (b)**

$$\frac{1 \text{ PSI}}{6.85 \text{ kPa}} = \frac{50.98 \text{ PSI}}{x \text{ kPa}}$$

$$x = 349.2 \text{ kPa}$$

**26) Answer (d)**

$$\text{PSI} = \text{head in feet} \times 0.434 \text{ PSI}$$

$$\text{PSI} = 72' \times 0.434 \text{ PSI}$$

$$\text{PSI} = 31.248 \text{ PSI}$$

Before the total force is calculated, the pressure in the pipe must be determined

$$\text{Total force} = \text{base area (in}^2\text{)} \times \text{pressure (PSI)}$$

$$\text{Total force} = (3.14) (1'')^2 \times 31.248 \text{ PSI}$$

$$\text{Total force} = 98.12 \text{ pounds}$$

**27) Answer (a)**

$$7'6'' = 7.5'$$

$$2'2'' = 2.167'$$

$$\text{PSI} = 2.167' \times 0.434 \text{ PSI}$$

$$\text{PSI} = 0.94 \text{ PSI}$$

Inches need be converted to feet to calculate PSI, and to make all the units uniform to later calculate the volume of the tank

$$\text{Total force} = \text{volume (ft}^3\text{)} \times 62.5 \text{ pounds/ft}^3$$

$$\text{Total force} = (10')(7.5')(2.167') \times 62.5 \text{ pounds/ft}^3$$

$$\text{Total force} = 162.525 \text{ ft}^3 \times 62.5 \text{ pounds/ft}^3$$

$$\text{Total force} = 10\,157.81 \text{ pounds}$$

Total force = Total weight

$$\text{Total weight} = 10\,157.81 \text{ pounds}$$

**28) Answer (b)**

$$\text{Capacity} = [(\text{persons in household} \times \text{gallons/day}) \times (\text{hardness value} + \text{iron concentration} \times \text{persons in household}) + 20\%] \times \text{days}$$

$$\text{Capacity} = (5 \times 75 \text{ gallons/day}) \times (8 \text{ grains/gallon} + 2 \text{ PPM} \times 5)$$

$$\text{Capacity} = 6750 \text{ grains/day}$$

$$20\% \text{ of } 6750 = 1350 \text{ grains}$$

$$\text{Therefore, Capacity} = [6750 + 1350] \times 5 = 35\,500 \text{ grains}$$

**29) Answer (b)**

$$\text{Total fall} = \text{length} \times \text{grade}$$

$$\text{Total fall} = (143 \text{ m}) (0.02)$$

$$\text{Total fall} = 2.86 \text{ m}$$

**30) Answer (a)**

$$\text{Total fall} = \text{length} \times \text{grade}$$

$$\text{Grade} = \text{total fall} / \text{length}$$

$$\text{Grade} = (30') / (120')$$

$$\text{Grade} = \frac{1}{4}'' \text{ per foot}$$

# Section 4

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## Test-taking Tips

## Test-taking Tips

(In this section, “test” also refers to “exam”.)

As you prepare to write the C of Q exam, you should consider some ideas or strategies to help you to be more successful. Read over the points below to see which ones might work for you.

1. **On the day of the exam, remain as calm as possible!** When you’re nervous or tense, your ability to read carefully declines. Take a deep breath and relax. When you sit down to write the exam, take some time to survey it and read all directions carefully. Read very slowly, running a finger under the words as you read to avoid mistakes.
2. **As you begin reading over the questions**, apply these three guidelines:
  - use your time wisely,
  - read directions carefully,
  - use good reasoning.
3. **If you don’t understand a question**, try to break it down into parts, or try and put it in your own words (but be careful not to change the meaning).
4. **Relate each possible answer to the question.** Consider how well each option answers the question. Is it a logical, correct response? Use the process of elimination to rule out wrong answers.
5. **If you are not sure of the correct response**, eliminate the “definitely not” option(s); judge the remaining options against each other (how are they the same/different); then choose the best remaining answer.
6. **Use information from other questions to help you:** Look for similar questions, or questions on the same topic; do the responses overlap? Is there any extra information you could use, e.g., a definition or similar work situation? Be on the lookout for questions that may answer other questions.
7. **Remember that you are being tested on the safe and correct way to do things.** Always answer using the “safe” method to complete a task on-the-job!
8. **Before the end of the exam**, make sure that you’ve answered every question. You won’t lose marks for wrong answers. **It’s better to guess at an answer than to leave it blank.** Eliminate any choices that are clearly wrong and then select your answer from the choices remaining. If you reduce your choices to two, you have a 50% chance of being right.

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# Writing a Multiple Choice Test

## Using the Best Approach

Answering multiple choice questions is a skill all on its own. Often test takers expect that a multiple choice exam will be easy – just a matter of recognizing true statements. However, on the C of Q exam you will be asked to do more than just recognize textbook material. Multiple choice questions require you to choose between correct and **nearly-correct** statements. So, you must read the questions very carefully.

Below are eight strategies for successfully tackling multiple choice questions.

### 1. Choose the answer which the test maker intended

- Try not to read into question interpretations not intended by the test maker, i.e. don't second guess the test maker's intentions. The questions are intended to demonstrate how much you know, not how the test maker can trick you.
- Keep in mind that the exam measures how well you know the material and how well you have been taught.

### 2. Anticipate the answer, and then look for it

- Read the question and anticipate what facts/aspects you think the answer will contain.
- Look for these among the possible answers.
- If the answer you anticipated is found among the options, it is probably correct.

### 3. Consider all the alternatives

- Read and consider all the options, even if you find your anticipated answer among the options.
- Remember that you must find the most correct answer.

### 4. Relate the options to the question

- When the answer you anticipated is not among the options, discard it and focus on the answers that are there. Consider how well each option answers the question.
- Although an answer provided may be a true statement, it must still be the correct answer to the specific question.
- Even though the answer may be an incorrect statement, it could be the correct answer in relation to the question, e.g. if the question asks, "Which statement is **not** correct?"

**5. Balance options against each other**

- When several options look good, or even if none look good, compare them with each other. If two options are highly similar, study them to find out what makes them different. One of these is likely the correct answer.
- Look for which answer is more likely in comparison not just with your own anticipated answer but with the other choices given.

**6. Use logical reasoning**

- Eliminate those options which you know to be incorrect as well as those which do not fit the requirements of the question.
- If you recognize more than one of the options as correct, choose one of the remaining options which combines both of these choices.

**7. Look for key words**

- True statements often contain terms such as “sometimes” or “usually”.
- A statement which includes the words “always” or “never” must be true 100% of the time.
- For the statement to be true, each part of the situation described in the statement must be true.
- Always read all the choices given. There may be an important alternative such as “all of the above” at the end.

**8. Specific, detailed answers tend to be correct**

- Although there will always be exceptions, options that are more detailed than others tend to be correct
- Pay special attention to options that are extra-long or highly specific.

## Test Anxiety

### What is Test Anxiety?

In simple terms, test anxiety is worrying a whole lot about how you’ll do on tests. You probably already know if you experience some (or maybe even severe) test anxiety.

Read below and decide if you think the descriptions apply to you:

**Mental anxiety:** you have thoughts and worries about tests and how you will perform, you believe how little or how poorly you studied.

**Physical anxiety:** you experience physical sensations and tensions such as light-headedness, nausea, pain and stiffness in the shoulders and back.

Everybody has anxiety before a test or exam! You are not alone. While a little anxiety improves concentration and alertness, excessive worry or anxiety, might lower your test score.

It is possible for test anxiety to interfere with clear thinking. The brain is like a computer, in that it contains a great deal of information, but the information is useless if you're not able to access it when you need it. Having test anxiety is like not having the password to your computer. The information is there, but you can't get to it.

### How can I reduce my anxiety before the exam?

To reduce test anxiety before the exam, study enough to feel confident that you know the material. Then try to replace the worry and negative thinking with thoughts that are positive and relaxing. Think – “I'm going to ace this exam!”...not...“ I don't have a chance of passing!”

Start studying early (weeks, not hours ahead!). Then, on the night before the exam, review the material but get a good night's sleep. Cramming increases test anxiety. If possible, try some sample multiple choice test questions if you have access to them through a prep course, text book, or website.

### On the Day of the Exam

- **Give yourself plenty of time to get to the exam.** Being lost, or late, will only add to your stress. If you are not familiar with the area, consider doing a “dry run” so that you will know where you are going and how long it takes to get there. Make sure you factor in where you will park and where the exam room is located.
- **Don't talk to other test-takers before the exam** as their anxiety will probably increase your anxiety. Refuse to participate in the last minute cramming that often goes on outside the exam room. This only leads to making you more nervous and might confuse you.
- **Walk into the test with your head up and your shoulders back.** How you act can affect how you feel, and if you act confident, you just might find that you feel more confident.

#### Pro Tip #5:

Visualize success...athletes do it all the time! Mentally practice *successfully* going through the exam experience.

## During the Exam

1. **Take a few minutes** to look over the exam, before you begin.
2. **Some people find it helpful to do an “information dump”** when they receive their test by writing important formulas, facts, etc. on scrap paper, while the information is fresh in their mind. As soon as you turn over your test paper, jot down quickly the formulae, memory cues, terms, names, etc. which you think you are most likely to forget. Not only will this begin the process of memory recall, it will reduce your test anxiety by ensuring that you have at least some of the information readily available.
3. **Answer the questions you know first.** This builds confidence and earns you some “insurance” marks. Normally, you don’t answer right on the question paper but on a separate answer sheet where you shade or circle the correct letter corresponding to the answer. **Check after every 10 questions to make sure that you are entering your answer on the correct line of your answer sheet.**
4. **Do not rush through the test.** Wear a watch or look at the clock on the wall. (You won’t be allowed to have your cell phone with you.) Be aware of approximately how much time you can devote to each question. For example, if you have 120 questions and you have 240 minutes, you have about two minutes to answer each question.
5. **If you are stuck on a question,** make a note of the question number on your scrap paper and come back to it later. (Make sure you don’t put a mark on the answer sheet where it will be scanned!) Don’t waste valuable time on material you don’t know at all when you could be earning marks for material you do know. Remain calm and know that there will be other questions that you can answer. Also, remember that you only have to correctly answer 70% of the questions!
6. **Be aware of your body.** Reduce tension by taking slow, deep breaths. Oxygen relaxes the body. Consciously relax your shoulders, jaw, neck and any other sites of tension.
7. **Do not reflect on past mistakes or failures.** Counter negative thoughts with statements like, “I don’t have to be perfect... I will do the best I can!” Use positive self-talk and positive self-statements. Avoid “all or nothing” thinking. Remind yourself that a test is only a test, and there can be opportunities to rewrite.
8. **Reward yourself after the exam** (movie, dinner out). Take a moment while you are writing the exam to think about this reward.

**Pro Tip #6:**

Try some relaxation techniques (deep breathing, tensing and relaxing different parts of your body, staying in the present tense and blocking out your worries) to help keep you calm.

## Additional Test-taking Hints: True or False?

Look at the hints below and decide whether they are true or false. Answers are below.

1. T/F \_\_\_ Multiple choice exams test your capacity to think and reason with the information you have. Do not expect to see the answer immediately. You have to work out the answer carefully.
2. T/F \_\_\_ Most of the time, changing your multiple choice answer at the end of the exam is not a good idea unless you can clearly see that you made a calculation or reading error.
3. T/F \_\_\_ Never look for key words or numbers.
4. T/F \_\_\_ Do not look for familiar phrases.
5. T/F \_\_\_ It is always useful to look for a pattern in the order that correct answers are given.

Answers:	1. T	2. T	3. F	4. F	5. F
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## **Section 5**

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# **Exam Readiness Checklist and Additional Resources**

## Exam Readiness Checklist

### How can you tell if you're ready to write the C of Q exam?

Here is a checklist you can use to see if you've done all that you can to prepare. If you can check off most of these, you are well on your way to being prepared to write the C of Q!

#### Paperwork

- Pay your exam fee to OCoT.
- Schedule your exam with MTCU.
- Ask for any necessary accommodations. (See Pro Tip 1 – page 11)
- Book time off work.

#### Preparation

- Arrange your transportation for the day of the exam, and complete a “dry run” to the exam location, especially if you haven't been there before.
- If you've taken the C of Q exam before, review the letter sent to you about your exam scores to determine your areas of strength and weakness.
- Talk with others who have written the C of Q exam in your trade.
- Review the [Trades Exams in Ontario Exam Preparation Guide](#)

#### Study, Study, Study!

- Create a study action plan.
- Look up your learning style, and adjust your studying methods accordingly.
- Review your textbooks.
- Look over the Apprenticeship Training Standard for your trade.
- Thoroughly review the National Occupational Analysis for your trade.
- Review the section in this booklet about test anxiety, and think about strategies that might work for you.
- Review the section in this booklet about test-taking, and think about which strategies might work for you.
- Study until you feel confident that you can recall at least 70% of the material in an exam situation.

#### The Day Before the Exam

- Have a healthy meal the night before the exam.
- Get a good night's sleep the night before the exam.
- Drink lots of water the day before the exam, and ensure you are hydrated on the day of the exam.

#### The Day of the Exam

- On the day of the exam, bring photo ID (not your health card).
- On the day of the exam, bring proof of having paid the exam fee.
- Visualize success!

## The Day of the Exam

When the day of your examination arrives, try to stay calm. After all, you've prepared yourself for this exam, and you are ready for it, so at this point, your overall feeling should just be "Get 'ER Done!!"

When you arrive at the examination centre, MTCU will ask you to provide proof of your identity, so bring photo ID with you. (Note that the Ministry cannot accept health cards as proof of identification.) You must also bring with you your receipt for your examination fee, which is issued by OCoT when you pay the fee.

Everything you need to write the exam will be provided to you. You are not to bring any supplies to the exam. When you sit down to write you will be provided with the following:

- The examination book, which you must not write in
- The answer sheet (place your answers on the answer sheet)
- Scrap paper
- A pencil and eraser
- A code book and/or calculator (if one is allowed for your exam)
- French and English dictionaries

Once the exam has started, you cannot leave the room until you've completed the exam, except in an emergency or to use the washroom.

### After the Exam

What happens after you write the exam? Celebrate all the hard work and time and effort you've put into preparing for the exam. Congratulations!

But what happens after that? Within three weeks you should have your exam results mailed to you by OCoT. **Keep in mind, MTCU cannot give you your exam results, nor can you get your results from OCoT by phone or in person.** All you can do is wait patiently and keep checking the mail!

Now here's a topic that nobody wants to think about... what if you don't get 70%? The main thing is, **don't give up!** You aren't alone in not passing; it is not unusual for apprentices to write the exam more than once.

You will be allowed to schedule another examination fifteen days after your previous examination date. OCoT will provide you with a breakdown of your marks according to the topics on which you were tested. This information will help you prepare for your next attempt, as you will be able to identify your areas of weakness and strength.

## Additional Resources

Some of the items in this list are also found in the previous pages. You may find them useful as you prepare for your C of Q exam and completion of your training.

### **Apprenticeship Completion Grant: Government of Canada**

- Information about a one-time payment for apprenticeship completion

<https://www.canada.ca/en/employment-social-development/services/apprentices/grants.html>

### **Apprenticeship Live Binder: Literacy Link South Central**

- Contains a wide selection of Apprenticeship information and resources.

[www.livebinders.com/play/play?id=1955776](http://www.livebinders.com/play/play?id=1955776)

### **Centennial College Press: Technical Trades**

- C of Q Preparation books available for purchase for various trades

<http://centennialcollegepress.com/product-category/technical-trades/>

### **Effective Habits for Effective Study**

- An online quiz about your study habits.

<http://www.studygs.net/attmot4.htm>

### **Trade and Apprenticeship Exam Bank**

- Fee-based service website that provides practice C of Q questions

<http://trades.exambank.com>

### **Interprovincial Red Seal Examination Preparation Information Guide**

- Describes how to use the NOA to prepare for your Red Seal exam.

<http://www.red-seal.ca/images/ATC-index-eng.html>

### **National Occupation Analysis (NOA)**

- Describes the skills and knowledge required to perform the duties of the trade.  
Consult your trade's NOA:

[http://www.red-seal.ca/resources/n.4.1\\_1.3st@-eng.jsp](http://www.red-seal.ca/resources/n.4.1_1.3st@-eng.jsp)

### **Red Seal Exam Counseling Sheets**

- List of topics by trade for Red Seal examinations

[http://www.red-seal.ca/resources/.2x.1ms\\_c.4.5ns.2ll.3ng@-eng.jsp](http://www.red-seal.ca/resources/.2x.1ms_c.4.5ns.2ll.3ng@-eng.jsp)

### **Red Seal Exam Readiness Checklist**

- Steps to see if you are you ready for your Red Seal examination.

<http://www.red-seal.ca/resources/pr.2p-ch.2ckl.3st@-eng.jsp>

### **Trades Qualification Learning Supports**

- Strategies for writing multiple choice trades exams from Apprenticeship Manitoba

[https://www.gov.mb.ca/wd/apprenticeship/pdfpubs/pubs/experienced\\_tradesperson/tq\\_learning\\_supports.pdf](https://www.gov.mb.ca/wd/apprenticeship/pdfpubs/pubs/experienced_tradesperson/tq_learning_supports.pdf)

### **Trade Exams in Ontario Exam Preparation Guide**

- From the Ontario College of Trades website

[https://www.collegeoftrades.ca/wpcontent/uploads/Exam\\_prep\\_guide\\_FINAL\\_March\\_2016.pdf](https://www.collegeoftrades.ca/wpcontent/uploads/Exam_prep_guide_FINAL_March_2016.pdf)

### **What's My Learning Style?**

- An online quiz to help determine your learning style.

<http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml>



# SUPPORTING APPRENTICESHIP COMPLETIONS

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**The Labour Market Group**  
Guiding partners to workforce solutions.

**EMPLOYMENT  
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