Instructional Methods: Classroom Lectures, Practical Lab Activities, Demonstrations and Videos

Course Format: Classroom: Individual and group work

Lab: Individual and group work (practical application)

Rationale:

Workplace Education Manitoba has listed 9 Essential Skills to be successful in any work place. All nine Essential Skills are used in different combinations, in different applications, in every occupation. They are the foundational skills you use to carry out your work tasks and they're the building blocks you use to learn new ones. The importance of - and need for - employees to have appropriate levels of workplace Essential Skills is clear and strong.

What specifically are the Essential Skills needed in the workplace?

To help answer this question, the federal government, since 1994, has surveyed more than 3000 Canadians in workplaces in all sectors and of all types and sizes of organizations. All were asked what workplace Essential Skills they felt were needed in order for workers to be most effective, efficient and productive.

The result has been the identification of the following nine workplace Essential Skills:

1. Reading
2. Writing
3. Numeracy
4. Document Use
5. Oral Communication
6. Working With Others
7. Thinking
8. Digital Technology
9. Continuous Learning

To help students be successful in their training, ATC has developed a package focused specifically on these Essential Skills and how they apply to the *Electrical Trades Program.* The purpose of this package is not to dissuade students from attending the program, but to help them become successful by informing them of the skills required. We highly encourage all students to take some time to work through the package and become informed of the program requirements.

Skill #1 Reading

Students will learn to read and interrupt the Canadian Electrical Code Book. The following three rules are from Section 30 which is titled **Luminaires in buildings of residential occupancy**

30-502 Luminaires in dwelling units (see Appendix G)

> (1) Except as provided in Subrule (2), a luminaire controlled by a wall switch shall be provided in kitchens, bedrooms, living rooms, utility rooms, laundry rooms, dining rooms, bathrooms, water-closet rooms, vestibules, and hallways in dwelling units.
> (2) Where a receptacle controlled by a wall switch is provided in bedrooms or living rooms, such rooms need not conform to the requirements in Subrule (1).

30-504 Stairways (see Appendix G)

> (1) Every stairway shall be lighted.
> (2) Except as provided in Subrule (3), three-way wall switches located at the head and foot of every stairway shall be provided to control at least one luminaire for stairways with four or more risers in dwelling units.
> (3) The stairway lighting for basements that do not contain finished space nor lead to an outside entrance or built-in garage, and that serve not more than one dwelling unit, is permitted to be controlled by a single switch located at the head of the stairs.

30-506 Basements (see Appendix G)

> (1) A luminaire shall be provided for each 30 m^2 or fraction thereof of floor area in unfinished basements.
> (2) The luminaire required in Subrule (1) that is located nearest the stairs shall be controlled by a wall switch located at the head of the stairs.

Code Questions:

1. In a stairway three way switches shall be located where?

2. Does an unfinished basement require three-way switching for the stairway lights?

3. How many luminaries are required for an unfinished basement with a total area of 115m^2?

4. Do livingrooms and kitchens need to have a luminaire controlled by a wall switch?

Skill #2 Writing

When working as an Electrician you will be required to record information about your work. This information will require materials used on jobs, time spent working on a job or travel time between jobs. This information is used for billing customers, warranty issues that may arise and for creating and developing a customer database. This information needs to be correct so the customer is billed correctly, the company makes a profit and you are paid correctly.

Students enrolled in the Electrical Trades Program will learn to develop a current resume, a business plan and perform basic accounting related to an electrical company.

Skill #3 Numeracy

The formula's most commonly used in the Electrical Trade are Ohm's Law and the Power Formulas. Ohm's Law states the Voltage (V) in volts = Current (I) in amps x Resistance (R) in ohms Ω

Ohm's Law formula V = I x R

Solve the following questions using the Ohm's law formula:

1. What is the resistance if there is 24V and the current is 1.65A?

2. What is the current if there is 50V and the resistance is 2500Ω?

3. What is the voltage if the resistance is 480Ω and the current is 0.12A?

Power Formulas

Power in watts (W) = Volts (V) x Current in amps (I)
P = V x I

Power in watts (W) = Current in amps squared (I²) x Resistance in ohms Ω(R)
P = I² x R

Power in watts (W) = Volts squared (V²) / Resistance in ohms Ω (R)
P= V²/R

Solve the following questions using the Power formulas:

4. What is the power in watts for a heater with 240V and 6.25A?

5. What is the power in watts for a circuit with 1500Ω and 480V?

6. What is the power in watts for a circuit with 1.25A and 1.2KΩ?

Fractions

7. Change the following fractions to lowest terms:

12/16 = _____   10/16 = _____

4/16 = _____   6/16 = _____

8. Change the following improper fractions to mixed numbers:

20/16 =_____   28/20 = _____

8/5 = _____   15/10 = _____

9. Change the following mixed numbers to improper fractions:

2 5/8 = _____   1 11/12 = _____

9 1/8 = _____   7 5/24 = _____

10. Add or subtract the following fractions:

12/16 + 1/8 = _____   4/5 – 2/3 =_____

6/10 – 1/4 = _____   4/9 + 7/8 =_____

11. Decimal conversions: Convert the following fractions to decimals.

1/16 =_____   7/8 = _____

3/4 = _____   5/16 =_____

Perimeter, Area and Volume

Find the perimeter and area of the following shapes.

12.

6'- 4 ½"
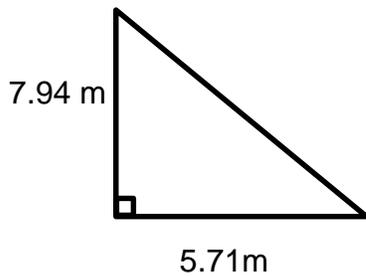
2'- 2

13.

1.46 m
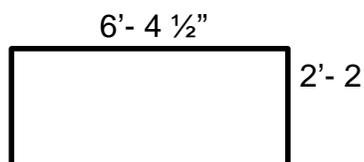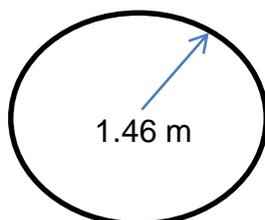
Trigonometry

Find the unknown side and the perimeter of the following right angle triangles using Pythagorean's theorem:

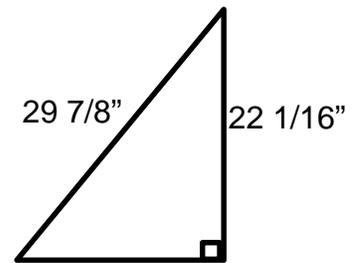$$\sin A = \frac{\text{side opposite } \angle A}{\text{hypotenuse}}$$

$$\cos A = \frac{\text{side adjacent } \angle A}{\text{hypotenuse}}$$

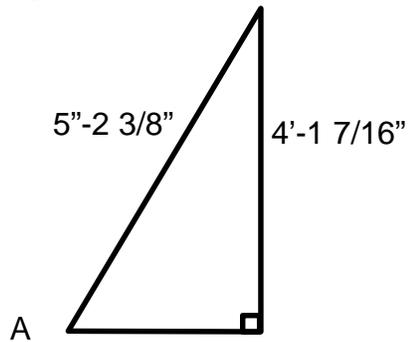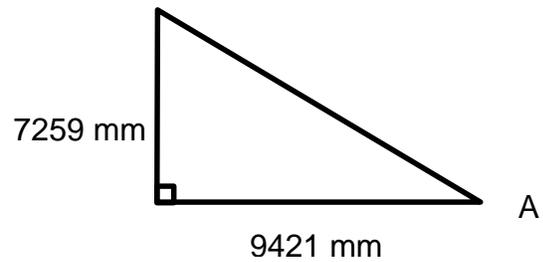$$\tan A = \frac{\text{side opposite } \angle A}{\text{side adjacent } \angle A}$$

14.

7.94 m

5.71m

15.

29 7/8"

22 1/16"

Note: Pythagorean's theorem is A² + B² = C².

16. Find angle A:

5"-2 3/8"

4'-1 7/16"

A

17.

7259 mm

9421 mm

A

Skill #4 Document Use

WHMIS labels are required for all products used in the workplace. As an Electrician working on various construction and manufacturing sites you will need to be able to understand a WHMIS supplier label.

1. Product Identifier - The product name exactly as it appears on the container and on the Material Safety Data Sheet

2. Supplier Identifier - The company which made or packaged the product, and is responsible for the label and MSDS information. Contact the supplier for additional information on the product

3. Hazard Symbols - One or more WHMIS symbols, depending on the WHMIS classification of the product

4. Risk Phrases - Brief statements of major hazards, based on the WHMIS classification of the product

5. Precautionary Measures - Brief descriptions of essential precautions, specific protective equipment, and emergency measures

6. First Aid Measures – Immediate steps to be taken by trained first aiders at the scene of an incident

6. MSDS Reference - Labels provide key information to alert you about critical hazards, precautions and first aid measures. The MSDS contains much more information on the safe use of the product. Always read the MSDS before working with a hazardous product.

Sulphuric acid is an electrolyte used in batteries for starting automobiles and generators. It is also found in the batteries used for uninterrupted power supplies (UPS) and solar power installations. As an Electrician, you will be responsible for the installation, maintenance and repairs to these systems.

SULPHURIC ACID, FUMING
ACIDE SULFURIQUE

Risk phrases:
HIGHLY IRRITATING TO SKIN, EYES AND NOSE.
Health Hazard Data:
STRONG ACID, VAPOURS HIGHLY TOXIC, BURNS SKIN ON CONTACT.
Precautionary Statements:
EYES: FACESHIELD AND GOGGLES GLOVES: RUBBER
Personal Protective Equipment:
RUBBER APRON, RUBBER BOOTS.
First Aid Measures:
EYES: FLUSH WITH LARGE QUANTITIES OF WATER. CONSULT PHYSICIAN AT ONCE.
SKIN: FLUSH WITH WATER. CONSULT PHYSICIAN.
Ingestion:
TREAT WITH BAKING SODA, MILK OF MAGNESIA OR LARGE QUANTITIES OF MILK. DO NOT INDUCE VOMITING.

Risque(s) possible(s):
EXTREMEMMENT IRRITANT POUR LA PEAU, LES YEUX AT LE NEZ.
Reinseignement sur les dangers pour la sante:
ACIDE FORTE, TRAITER COMME POUR L'ACIDE FORTE.
Surexposition aigue: PEAU ET YEUX.
Measures de precaution:
EQUIPMENT DE PROTECTION SPECIFIQUE:
YEUX: ECRAN FACIAL ET LUNETTES
GANTS: EN CAOUTCHOUC
Autre vetements et equipment:
TABLIER EN CAOUTCHOUC, BOTTES EN CAOUTCHOUC.
Premiers Soins:
YEUX: BIEN RINCER A GRANDE EAU PENDANT 15 MINUTES. CONSULTER UN MEDECIN.
Peau: RINSER A L'EAU. CONSULTER UN MEDECIN.
Ingestion: TRATER COMME POUR L'ACIDE FORTE. CONSULTER UN MEDECIN.

REFER TO MATERIAL DATA SHEET FOR FURTHER INFORMATION.
POUR PLUS D'INFORMATION, CONSULTER LA FICHE SIGNALETIQUE.

ACME Chemicals, Somewhere, ON. A1A 1A1 (111) 111-1111

The following questions deal with the above WHMIS label.

1. What is the name of the company that manufactures this product?

_____

2. How many hazard symbols are provided on the label?

_____

3. What is the product name that appears on the label?

_____

4. What personal protective equipment is required when handling this product?

_____

Skill #5 Oral Communication

Students entering the Electrical Trades Program will be required to take the Apprenticeship Preparation Course. One of the components of the course is oral presentations. Students are required to complete two presentations; the first one is three minutes long and can be on any topic the student chooses. The second presentation is five minutes in length and will be on a topic related to the electrical trade.

Skill #6 Working with Others

There are many times when students will be required to work in groups or in the same area as other students. Students will be required to work well with others, maintain a team approach to group work and maintain a professional attitude towards others in the program. These skills are essential to have when entering the electrical trade. It is not uncommon to have more than one trade on a job site at a time. It is not uncommon for a large construction project to have hundreds of trade's people working on the same site at the same time. It is essential that students possess a team approach when entering the construction trade.

Skill #7 Thinking

Electricians are required to think their way through problems encountered while on the job site. Situations that involve safety, equipment repairs and material installations require strong mechanical and spatial thinking.
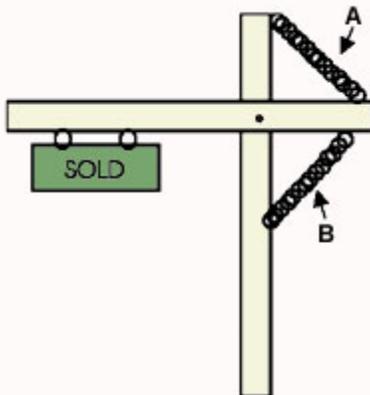
Mechanical reasoning measures the ability to understand basic mechanical principles of machinery, tools, and motion.

Example 1 Which direction will gear "D" be going?
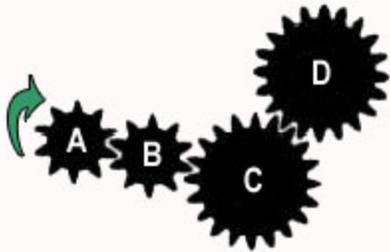
1. Same rotation as "A"

2. Same rotation as "B"

3. Same rotation as "C"

Example 2 Which chain will hold the sign?

1. Chain A

2. Chain B

3. Both chains are required

4. Neither chain is required

Example 3 If Triangle "A" weighs 10 kg, how much does Triangle "B" weigh?

1. 10 Kg

2. 20 Kg

3. 25 Kg

4. 15 Kg

Spatial-temporal reasoning is the ability to visualize spatial patterns and mentally manipulate them over a time-ordered sequence of spatial transformations.

This ability is important for generating and conceptualizing solutions to multi-step problems that arise in areas such as architecture, engineering, science and mathematics.

Example 4 Which of the 4 answer figures (a, b, c, d) could be made by folding the pattern below?

a: b: c: d:
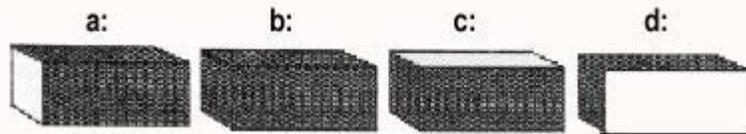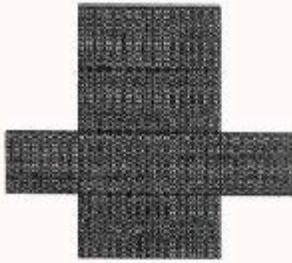
Example 5 Do the figures shown below match?
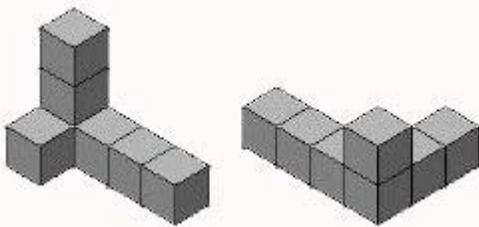
1. Yes

2. No

Skill #8 Digital Technology

The following link has been provided for your information on apprenticeships in Manitoba.

http://www.gov.mb.ca/tce/apprent/index.html

Using the Manitoba Apprenticeship website, locate and double click the **apprentice** box on the left side of the screen.

Again on the left side of the screen locate and double click the **Frequently Asked Questions (FAQs)** box.

The following questions deal with the Frequently Asked Questions found on the web site.

1. How much does 10 weeks of technical training cost?

2. What is a Journeyperson?

3. What is a compulsory trade?

4. Is a Construction Electrician or an Industrial Electrician a compulsory trade?

5. Why is it important to be certified?

6. Using the supplied link above find the length and the required levels of technical training for a Construction Electrician?

7. What are the total hours per level?

Skill #9 Continuous Learning

The 2012 Edition of the Canadian Electrical Code book is currently 643 pages. In 2006 the Canadian Electrical Code book was 574 pages. Due to changes in the Electrical Code, the Canadian Building Code, equipment and technology, students entering the Electrical Trades Program will need to become continuous learners. As a Journeyperson in the Electrical Trade you will be required to know about changes to the Canadian Electrical Code book, City of Winnipeg Electrical Bylaws, Manitoba Hydro Electrical Bylaws and some of the Canadian Building Code. This information is provided through upgrade courses or from the Inspection Authority. It is the responsibility of the Journeyperson to stay current with changes to codes and regulations.

Answer key

Reading

1. Three-way wall switches are located at the head and foot of every stairway.

2. No, the stairway lights are permitted to be controlled by a single switch located at the head of the stairs.

3. 4 lights are required ($115m^2/30 \ m^2 = 3.83$)

4. Yes, a luminaire controlled by a wall switch shall be provided in kitchens and livingrooms.

Numeracy

1. R = 24V/1.64A   R = 14.54Ω

2. I = 50V/2500Ω   I = 0.02A

3. V = 480Ω x 0.12A   V = 57.6V

4. P = 240V x 6.25A   P = 1500W

5. P = 480V²/1500Ω   P = 153.6W

6. P = 1.25² x 1200Ω   P = 1875W

7. 12/16 = 3/4   10/16 = 5/8   4/16 = 1/4   6/16 = 3/8

8. 20/16 = 1 1/4   28/20 = 1 2/5   8/5 = 1 3/5   5/10 = 1 5/10

9. 2 5/8 = 21/8   1 11/12 = 23/12   9 1/8 = 73/8   7 5/24 = 173/24

10. 12/16 + 1/8 = 14/16 = 7/8   4/5 − 2/3 =   2/15
     6/10 − 1/4 = 7/20   4/9 + 7/8 =   88/72 = 11/8

11. 1/16 = 0.0625   7/8 = 0.875   3/4 = 0.750   5/16 = 0.3125

12. P = 17'-1 ½"   A = 13' − 11¼"

13. P = 9.17m   A = 6.69m²

14. 9.78m

15. 20'- 1 11/16"

16. 52.43°

17. 37.6°

Document use

1. ACME Chemicals

2. 2 hazard symbols

3. Sulphuric acid

4. Rubber apron, rubber boots, rubber gloves, faceshield and goggles

Thinking

Example 1 Gear "D" will be going the same as gear "B". (Choice 2)

Example 2 Because of the weight of the sign, chain "B" will hold it.

Example 3 Because the point of support is centered and the triangles are at the same level, Triangle "B" weighs the same as "A" (Answer choice 1: 10 kg).

Example 4 As the example pattern is completely darkened, only a "complete darkened figure" can be made from folding it. Therefore, the answer is "b", because all the other answer choices have a figure with a side that is white.

Example 5 Both figures have the same number of cubes, but they DO NOT match, because the cubes are placed in a different position.

Digital Technology

1. $250.00

2. A journeyperson is an expert in a particular trade. He or she holds a Certificate of Qualification in their trade.

3. A compulsory trade is a trade in which you must be a registered apprentice or a certified journeyperson to legally work in Manitoba.

4. Yes

5. It is proof that a tradesperson has all the training and skills needed to perform tasks. Certified journeypersons also have a better chance in being promoted and making more money.

6. 4 levels and they are 10 weeks in duration. http://www.gov.mb.ca/tce/apprent/forms/pdf/curriculum/const_elec_levels.pdf

7. 350 hours per level