

MODULE 3: Communication and Terminology for the Workplace

TOPIC 4: A – Describing Processes Using Flow Charts

B – Converting Measurements

LEARNING OUTCOMES:

By the end of lesson (Topic 4A), participants will be able to:

- ◆ verbally describe a familiar process related to engineering or the workplace using a flow chart
- ◆ critically analyze a flow chart and suggest improvements for efficiency of a process

By the end of lesson (Topic 4B), participants will be able to:

- ◆ identify metric equivalents for imperial measurements
- ◆ convert measurements from imperial to metric

TOPIC	SKILLS	CLB COMPETENCE AREA	COMPETENCIES	PRE-TASKS	TASK	POST-TASK
Topic A <ul style="list-style-type: none"> ◆ Describing Processes Using Flow Charts 	<ul style="list-style-type: none"> ◆ Listening/ Speaking ◆ Writing 	<ul style="list-style-type: none"> ◆ exchanging information ◆ formatted text filling out/ constructing 	<ul style="list-style-type: none"> ◆ describe engineering or other workplace processes using sequencers and referring to agents, actions, and circumstance ◆ apply current practices for quality assurance to a familiar process 	<ul style="list-style-type: none"> ◆ reflect on processes in previous engineering practice ◆ draw a process using a flow chart 	<ul style="list-style-type: none"> ◆ describe the process verbally using sequencers and explanations of purpose 	<ul style="list-style-type: none"> ◆ critically analyze a process for more efficiency
Topic B <ul style="list-style-type: none"> ◆ Converting Measurements 	<ul style="list-style-type: none"> ◆ Listening/ Speaking ◆ Reading 	<ul style="list-style-type: none"> ◆ exchanging information ◆ informational text, evaluation and analysis 	<ul style="list-style-type: none"> ◆ understand the metric equivalents of imperial measurements ◆ apply conversion formulas for imperial to metric 	<ul style="list-style-type: none"> ◆ identify imperial and metric terms used for length, area, cubic volume, liquid or dry volume and weight ◆ read an imperial to metric conversion chart 	<ul style="list-style-type: none"> ◆ convert imperial measurement to metric in an engineering context 	<ul style="list-style-type: none"> ◆ compare answers to converting questions

Facilitator's Guide for Module 3
Topic 4A: Describing Processes Using Flow Charts
4B: Converting Measurements
FACILITATOR PREPARATION

Topic 4A

Content

For this topic, additional background reading is not necessary. The post-task allows participants to apply some of the workplace-management practices from Module 3 Topic 1.

Delivery

The facilitator should prepare the following reference material on chart paper:

- ◆ Three standard flowchart symbols from Introduction 2
- ◆ List of workplace processes from Pre-task 1
- ◆ Standard flow chart symbols from Pre-task 2
- ◆ List of sequencers and conjunctions for explaining purposes for pre-task 2

Materials needed: OHP, OHT 1, chart paper and markers

Topic 4B

Content

The facilitator should be comfortable with Imperial to Metric conversion formulas, which are provided.

Delivery

As many copies as necessary should be made of the following handouts:

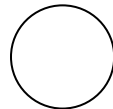
- ◆ Handout 1 Conversion Chart
- ◆ Handout 2 Conversion Problems

Materials needed: chart paper and markers, calculator; (optional: Imperial measuring tools such as rulers, a yard stick, or other measuring devices)

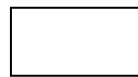
Topic 4A: Methodology

Introduction

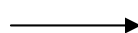
- (20 minutes)**
- On an overhead projector, show OHT 1 (the mouse trap). Have the class explain the process and label the machine as a whole class activity. The class should mention: crane, boxing glove, pulley, conveyor belt, boot, cage. The process is:
 - * the mouse is kicked into the cage;
 - * the cage is lifted up;
 - * the mouse is punched onto the conveyor belt;
 - * it is carried along and dropped into the sugar;
 - ⊕ it's picked up;
 - ⊕ placed in the cat's mouth and eaten.
 - How would this process be depicted in a flow chart? Give the class the following symbols to work with:



circle - marks the beginning or end of a process

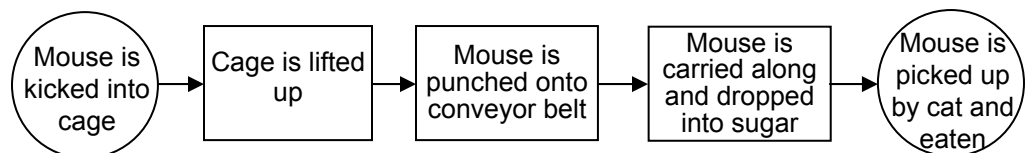


rectangle - marks an operation of a process



arrow - shows direction of flow

Give the participants five minutes to depict the process on a flow chart. Then have one participant draw their flow chart on the blackboard. This is a sample flow chart; but engineers may make it more complicated.

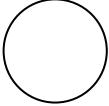
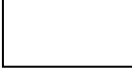
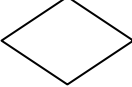
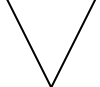




Pre-Tasks

(25 minutes) 1. Have the participants brainstorm different kinds of processes in the workplace from their previous engineering experience. Have the following processes listed on chart paper for additional reference:

- ◆ a production process
- ◆ staff recruitment process
- ◆ wage negotiations
- ◆ staff training process
- ◆ a job application procedure
- ◆ communications procedures
- ◆ ordering process
- ◆ service procedures
- ◆ a product development process
- ◆ an engineering-specific process (e.g., a chemical process)

Have the participants draw a flow chart to describe the procedure they have chosen. Have them think of a flow chart as a map that enables one to complete an activity. Some of the more standard symbols are:

-  circle - marks the beginning or end of a process
-  rectangle - marks an operation of a process
-  diamond - is used to indicate decisions
-  triangle - is used for hold or storage
-  D - marks a delay
-  arrow - shows direction of flow

(Have these prepared on chart paper)

Differentiate between a step and a stage. A step is one action in a process. A stage is a series of actions that forms part of a process.

Also, make sure that the following sequencers and conjunctions are available as a reference for the task.

<u>Sequencers</u>	<u>Explaining Purpose</u>
◆ First(ly) . . .	◆ To . . .
◆ Second(ly) . . .	◆ In order to . . .
◆ Then . . .	◆ So that . . .
◆ Next . . .	◆ In order that . . .
◆ After that . . .	◆ Because . . .
◆ Having (previously) been . .	
◆ At the same time . . .	
◆ Simultaneously . . .	
◆ Lastly . . .	
◆ Finally . . .	

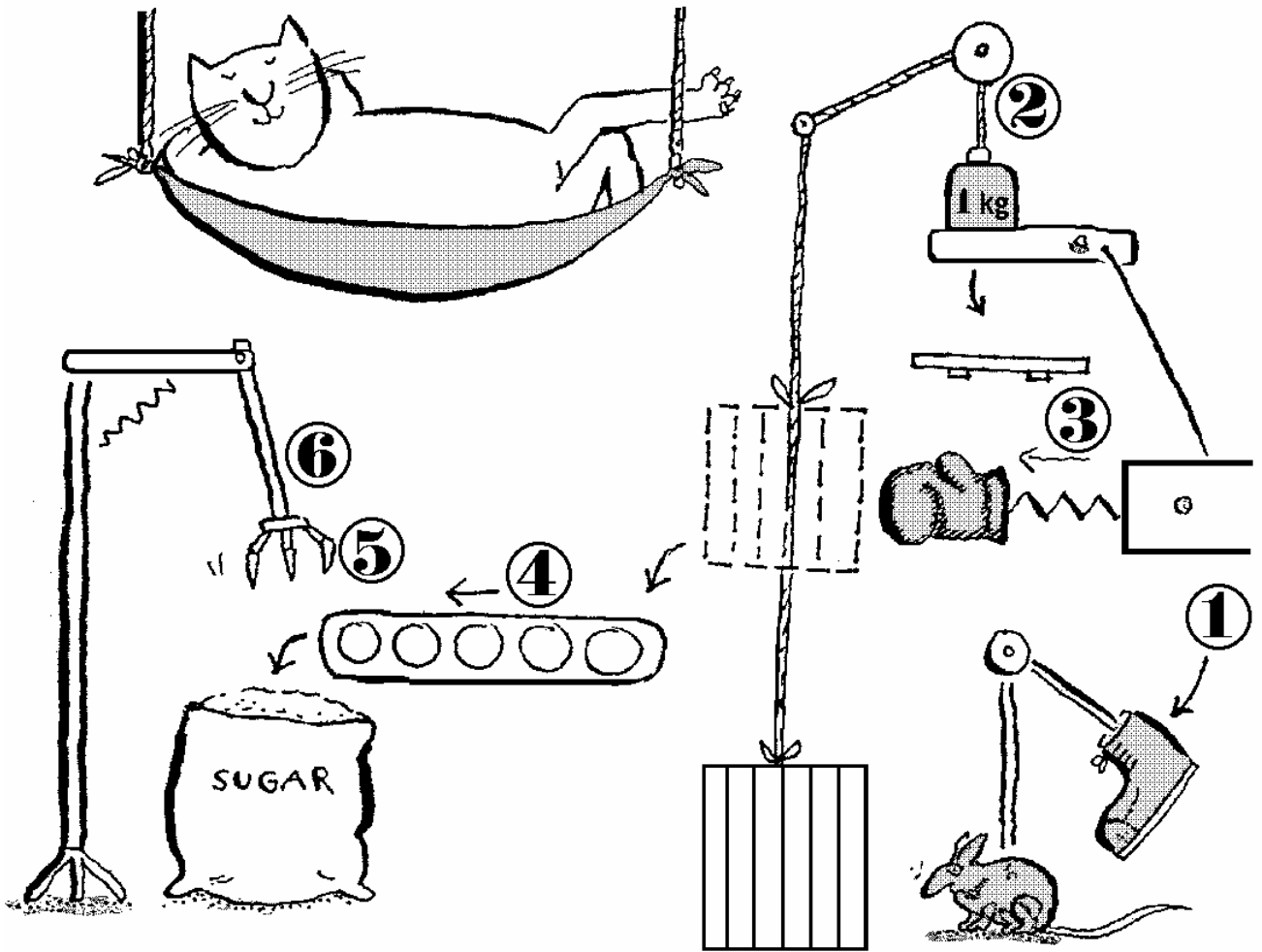
Task

- (20 minutes)** 1. Have participants describe orally the process they have charted to a partner, referring to their flow chart and explaining the sequence of events. Have them explain to their partner why things are done in the way they are.

Post-Task

- (15 minutes)** 1. Have the participants think about the workplace practices that they discussed in the previous lesson – TQM, JIT, SPC etc. What was the general purpose of these practices? (efficiency, quality assurance, no waste or down time). Have the participants analyze their flow charts (or that of their partner’s) for areas where improvements can be made to the process. Encourage them to think like managers and eliminate “non-value added” (or inefficient/unnecessary) steps in the process.

OHT 1



Source: Hollet, V., R. Catter, L. Lyon and E. Tanner. *In At The Deep End: Speaking Activities for Professional People.* Oxford: Oxford University Press, 1991

Methodology for Topic 4B

Introduction

- (10 minutes) 1. Elicit from the participants what they know about different measurement systems. They should mention imperial and metric.

Mention that, until recently, Canada and U.S. used the imperial system of measurement, and that these units are still referred to and used, particularly by people thirty-five years of age and older. Ask the class if they can think of some potential workplace problems that could arise from the confusion. Relate to them the story of when an Air Canada jet had to make an emergency landing because it had run out of fuel. The captain thought that the refuelling crew was quoting him a number in kilograms when they were speaking in pounds (1kg = 2.2 lbs).

Pre-Tasks

- (10 minutes) 1. Explain that the imperial system is still widely used in the workplace. Ask the class if anyone knows what the imperial system is based on. If not, explain that the imperial system was based on the convenience of things at hand. Centuries ago, the thumb inspired the inch; the foot left its imprint; the arm pointed to the cubit, yard, and fathom; and 1,000 double paces led to our mile. This system has useful units, but inconvenient conversion factors from one unit to another. When compounded to include more units of length, volume, and mass, the complexity becomes chaotic. The imperial system, with such conversion factors as 2, 3, 4, 5½, 6, 8, 9, 12, 14, 16, 22, 32, 40, 1,760, 4,840, 5,280, and 7,000, is too complicated for practical use.
- ◆ 12 inches = 1 foot
 - ◆ 3 feet = 1 yard
 - ◆ 5,280 feet = 1 mile

- (20 minutes)** 2. Divide the class into five groups: one group deals with length; the others with area, cubic volume, and liquid or dry volume and weight. Each group is given a sheet of chart paper divided in half: one for metric and one for imperial measurement. Have each group identify units of measurement for their category. Then, as a whole class, take up the information on the charts, ensuring the following items are covered:

	Imperial	Metric
Length	inch foot yard mile	millimetre centimetre metre kilometre
Area	square inch square feet square yard acre square mile	square centimetre square metre hectare square kilometre
Volume (cubic)	cubic inch cubic foot cubic yard	cubic centimetre cubic decimetre cubic metre
Volume (liquid/dry)	fluid ounce quart pint gallon	millilitre litre
Weight/Mass	ounce pound ton	gram kilogram tonne (metric ton)

Adapted from Black, G.J. Canada Goes Metric. Doubleday Canada, 1980. pp. 121-4.

- (10 minutes)** 3. For the participants, it is most important to convert from imperial to metric. Emphasize that the conversions they will be given are accurate for daily use, but are not accurate enough for mechanical engineers, who deal with exact measurements. Explain that to convert from one measurement to another requires multiplication. Due to time constraints, we will convert imperial to metric. Tell the class to imagine someone is talking to them about 50 acres of land and they have no idea how big this is; what should they do? Distribute Handout 1 (Imperial to Metric Conversion Chart).

Task

- (30 minutes)** 1. Distribute Handout 2 for some mathematical problem solving involving conversion in an engineering context. Note that in problem 3 there is a conversion involving Canadian and U.S. gallons.

Post-Task

- (20 minutes)** 1. Have participants compare answers to the conversion questions.

Handout 1

Imperial to Metric Conversion Chart

To Convert	To	Multiply by
1. Length		
inch	centimetre	2.54
feet	metre	0.3048
yard	metre	0.9144
mile	kilometre	1.609
2. Area		
Square inch	Square centimetre	6.452
Square feet	Square centimetre	929.030
Square yard	Square metre	0.836
Acre	Hectare	0.405
Square mile	Hectare	258.999
Square mile	Square kilometre	2.59
3. Volume (cubic)		
Cubic inch	Cubic centimetre	16.387
Cubic feet	Cubic decimetre	28.317
Cubic yard	Cubic metre	0.7645
4. Volume (liquid / dry)		
Fluid ounce	Millilitre	28.413
Pint	Litre	0.5683
Quart	Litre	1.1365
Gallon	Litre	4.546
5. Mass/Weight		
Ounce	Gram	28.35
Pound	Gram	453.592
Ton	Tonne (Metric Ton)	1.016

Handout 2

Answer the following questions using the conversion chart.

1. The production line at the Hershey factory runs at a speed of 2.5 feet per 10 seconds. The industrial engineer has been asked to double the speed of the line. What will be the new speed of the production line in metric?
2. While buying gasoline for a portable electric generator in the United States, a Canadian electrical engineer noted that the price was US\$1.27 per U.S. gallon. She knew that 1 U.S. gallon was 3.785 litres. What was the price of that gasoline for 1 imperial gallon?
3. To prepare the site for the foundation of a factory, an engineer calculated that he would have to extract 410 cubic yards of earth, which would have to be removed from the site. The trucks removing the earth can carry 30 cubic meters of earth at one time. If there's only one truck available, how many trips would be required to remove all of the earth for the foundation?

FACILITATOR'S NOTES

Answer Key to Handout 2

1. *The production line at the Hershey factory runs at a speed of 2.5 feet per 10 seconds. The industrial engineer has been asked to double the speed of the line. What will be the new speed of the production line in metric?*

1 foot = 0.3048 m

2.5 feet = (2.5 x 0.3048) = 0.762 m

therefore the original speed in metric was = 0.762 m / 10 sec

doubled, the speed is = 1.524 m / 10 sec

2. *While buying gasoline for a portable electric generator in the United States, a Canadian electrical engineer noted that the price was US\$1.27 per U.S. gallon. She knew that 1 U.S. gallon was 3.785 litres. What was the price of that gasoline for 1 imperial gallon?*

US\$1.27 for 1 U.S. gallon or 3.785 litres,

therefore the price for 1 litre = $\frac{1.27}{3.785}$ US\$0.335

4.546 litres equals 1 imperial gallon

therefore, the price for 1 imperial gallon = 4.546 x 0.335 = US\$1.523

3. *To prepare the site for the foundation of a factory, an engineer calculated that he would have to extract 410 cubic yards of earth, which would have to be removed from the site. The trucks removing the earth can carry 30 cubic meters of earth at one time. If there's only one truck available, how many trips would be required to remove all of the earth for the foundation?*

410 cubic yards = 410 x 0.7645 = 313 cubic metres

1 truck carries 30 cubic metres,

therefore, to remove 313 cubic metres would require = $\frac{313}{30}$ = 10.45 trips or 11 trips

Terminology List

Imperial System of Measurement

- ◆ inch
- ◆ feet
- ◆ yard
- ◆ mile
- ◆ acre
- ◆ fluid ounce
- ◆ pint
- ◆ quart
- ◆ gallon
- ◆ ounce
- ◆ pound
- ◆ ton