

# Units of Weights and Measures Research Activity

## Instructor Guide

### Note to Instructor

This research activity for Weights and Measures presents three discussion problems related to weights and measures. This activity should be assigned after students have read the primary knowledge unit on the Units of Weights and Measures.

*Units of Weights and Measures* Learning Module includes the following:  
Knowledge Probe (KP) or Pre-Quiz

- Units of Weights and Measures Primary Knowledge (PK)
- **Research Activity**
- Conversion Activity
- Final Assessment

The companion Instructor Guide (IG) contains all of the information in the PG as well as answers to the Post-Activity questions.

### Description and Estimated Time to Complete

This activity provides three separate discussion points:

- Current International Standard of Units (SI),
- United States' resistance to adopting the SI
- Use of metrics within MEMS technology.

This activity will help you to better understand the factors affecting design, fabrication, and commercialization of microsystems. It should open your eyes to the problems faced by scientists, engineers and technicians in educating the general population on micro and nanotechnology.

### Estimated Time to Complete

Choose at least one of the discussion points to research and write about. Allow approximately 3 hours for completion of each discussion problem.

## Introduction

A unit of measurement is a standardized quantity of a physical property, such as length, weight, time, and temperature. Some of the first units of measurement were units of length, many of which were derived from the length of a body part.

Throughout history, the standards for units of weights and measures have continued to change. Different standards have been used by different countries and at times, within the same country. These factors have created the need for continuous conversion from one standard to another, from one unit to another. Today there is a global standard, the International System of Units (SI), which is the current metric system. As of 2007, the SI standard has been adopted by all but three countries: United States, Liberia, and Myanmar (Burma). It is universally recognized as the standard for science and technology.<sup>1</sup>

The following discussion problems allow you to further explore the units of the SI, the United States efforts toward metrication, and the use of metrics in MEMS Technology.

<sup>1</sup> The World Factbook. Appendix G – Weights and Measures. Update 1/1/07.

<https://www.cia.gov/library/publications/the-world-factbook/appendix/appendix-g.html>

## Activity Objectives and Outcomes

### Activity Objectives

- Discussion 1: Compare and contrast the metric system and the US system of weights and measures
- Discussion 2: Discuss the United States' efforts toward metrication
- Discussion 3: Discuss the use of metrics within MEMS Technology.

### Activity Outcomes

Upon completion of any or all of these discussions you should be able to support your argument – one way or another – as to whether or not the United States should enforce the use of the SI at all levels, and phase out the current US System of Weights and Measures.

## Team

It is recommended to complete these discussion problems in small groups (2-3 participants). This will allow for discussion that may consider various viewpoints. Such back and forth will help when completing the written documentation.

## Resources

Be sure to record and report all references and resources that support your discussions and arguments.

## **Discussion Problem I: Systems Comparison**

A comparison of the current United States (US) System of Weights and Measures with the current metric system adopted by the SI.

### **Documentation**

The documentation for this discussion will consist of a written report that must include, but is not limited to the following:

- A comparison of the current US System of Weights and Measures with the current metric system based on the seven base units of the SI and the SI prefixes.
- A summary of how each system of measurement is used within the United States.
- A discussion on problems that have emerged as a result of operating under two systems of weights and measures (if any exist).
- Graphics (when needed to support discussion)
- References for information, materials, and graphics
- Answers to the Post-Activity Questions (Discussion Problem I)

### **Procedure: Systems Comparison**

#### **Description**

In this discussion you will compare and contrast the US System of Weights and Measures with the seven basic units of the current metric system adopted by the International Standards of Units.

1. Research the unit equivalent of each of the seven basic units of the SI metric system, applications of each system with the US, and any problems that have emerged due to the use of both systems.
2. Complete a written report fulfilling the documentation requirements.
3. Answer the Post-Activity Questions for Discussion Problem I.

### **Post-Activity Questions / Answers**

*The Post-activity questions for this discussion are primarily opinion questions. The answers should provide appropriate justification for the opinion expressed.*

1. Which system (US or metric) do you find to be the simpler system to use? (Explain your answer)
2. Which system do you find to be the simpler system when converting to larger or smaller quantities of a unit? (Explain your answer)
3. Discuss the advantages of one system over the other.

## **Discussion Problem II: US Metrication Process**

Discuss the United States' efforts toward metrication.

### **Documentation**

The documentation for this discussion will consist of a written report that must include, but is not limited to the following:

- A discussion on the current efforts of the United States toward metrication.
- Your personal opinion of this process and its effectiveness.
- Your personal opinion as to whether or not this conversion is needed. Why or why not?
- Graphics (when needed to support the discussion)
- References for information, materials, and graphics
- Answers to the Post-Activity Questions (Discussion Problem II)

### **Procedure: US Metrication Process**

#### **Description**

Research the United States' efforts toward metrication. Discuss your personal opinion of this process and the need for this conversion.

1. Research the United States' efforts toward metrication.
2. Complete a written report fulfilling the documentation requirements.
3. Answer the Post-Activity Questions for Discussion Problem II.

### **Post-Activity Questions**

*The Post-activity questions for this discussion are primarily opinion questions. The answers should provide appropriate justification for the opinions expressed.*

1. What do you feel is the most significant factor in preventing a total conversion by the United States to the metric system?
2. Most of us in the Science and Technology fields have to deal with both the metric and US system of weights and measures. How has dealing with two different systems affected you – both personally and professionally?
3. At what grade level should the metric system be taught? Justify your answer.

### **Discussion Problem III: Metrics and MEMS Technology**

Research the use of metrics within MEMS Technology.

#### **Documentation**

The documentation for this discussion will consist of a written report that must include, but is not limited to the following:

- A discussion on the use of metrics with MEMS Technology.
- Graphics (when needed to support discussion)
- References for information, materials, and graphics

#### **Procedure: Metrics and MEMS Technology**

##### **Description**

Research the use of metrics within MEMS Technology. Identify common SI units used in various applications. Briefly discuss the advantages or disadvantages of metrics vs. the US units for MEMS Technology.

1. Research the use of metrics with MEMS Technology. Your research should include, but is not limited to the following:
  - a. A brief discussion of metrics within MEMS Technology.
  - b. Specific units used for specific applications (e.g.  $\mu\text{m}$  and  $\text{nm}$  for length, width and height of cantilevers)
  - c. Advantages and disadvantages of metrics vs. the US units for MEMS Technology
2. Complete a written report fulfilling the documentation requirements

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