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# What are Sensors? Activity

## Instructor Guide

### Notes to Instructor

This is the Activity for the *Introduction to Sensors Learning Module*.

*Introduction to Sensors Learning Module* consists for the following:

- Knowledge Probe (Pre-assessment)
- Introduction to Sensors PK
- **Activity: What are Sensors?**
- Final Assessment

This 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 learning module is one of three SCME modules that discuss the types of components found in microelectromechanical systems (MEMS). This module covers “sensors” – what they are, how they work and how they are used in both macro and micro-sized systems.*

This activity provides you the opportunity to further enhance your knowledge and understanding of sensors both in the macro and micro-scales. You will explain how specific sensors work.

#### Estimated Time to Complete

Allow 2 hours to complete this activity.

## **Introduction**

A sensor is a device that receives and responds to a signal. The signal must be some type of energy, such as heat, light, electrical, motion, or chemical reaction. In many cases, the energy input to a sensor is the output of a transducer. Once a sensor detects one or more of these signals (an input), it converts it into an analog or digital representation of the input signal. Based on this explanation of a sensor, you should see that sensors are used in all aspects of life to detect and/or measure many different conditions.

## **Activity Objectives and Outcomes**

### Activity Objectives

- Define sensor.
- Explain how two different types of sensors work.
- Identify the micro-equivalent of two macro-sized sensors.

### Activity Outcomes

Upon completion of this activity you should have a more in-depth understanding of sensors, the different types of sensors, and the differences and similarities between macro and micro-sized sensors.

## **Documentation**

The documentation for this activity consists of a written report. Details of the report are given in the following procedure.

Documentation should include the following:

- Information required in the activity procedure
- Graphics (if available)
- References for materials, information, and graphics
- Answers to the Post-Lab Questions

## Activity: What are Sensors?

### Procedure:

1. Select two sensors that you would like to research further. The sensors you select can be from the following list or one from the list and another from your personal interests.
  - a. Infrared thermometer
  - b. Blood pressure monitor
  - c. Solar cell
  - d. Tilt sensor for iPhone screens
  - e. Ammonia sensor
2. Research the two sensors and write a report that addresses no less than the following information:
  - a. Type of sensor
    - i. What type of sensor is this (pressure, motion, thermal, optical, chemical, etc.)?
    - ii. Is this sensor macro-sized, micro-sized or both?
  - b. Operation
    - i. How does this sensor work at the macro scale?
    - ii. How does this sensor work at the micro scale?
    - iii. If this is a macro-sized only sensor, what is a micro-sized sensor that is used in similar applications (if there is one)?
    - iv. What are the similarities and differences between the macro and micro scaled sensors?
  - c. Applications
    - i. What are some current applications for this sensor in both the macro and micro-scales?
    - ii. What are some possible applications for which this sensor could be used?

### **Post-Lab Questions**

1. What is a sensor?
2. How does a sensor differ from a transducer?
3. Micro-sensors have been around for many years especially in fields such as consumer products. Cars, computers, cameras, cell phones, and home appliances all have micro-sensors. What particular field (e.g., civil engineering, biomedical, aerospace) do you see as having endless possibilities for the use of micro-sized sensors? Discuss some of these possibilities.
4. Identify at least five types of sensors found in your car and explain what each sensor senses.

## Post-Lab Questions / Answers

1. What is a sensor?

*A sensor is a device that receives and responds to a signal. The signal must be some type of energy, such as heat, light, electrical, motion, or chemical reaction. In many cases, the energy input to a sensor is the output of a transducer. Once a sensor detects one or more of these signals (an input), it converts it into an analog or digital representation of the input signal.*

2. How does a sensor differ from a transducer?

*A sensor does not convert energy from one form to another. Many sensors consist of a transducer and the electronics needed to evaluate the transducer's input and output. A sensor is as a device that receives and quantifies that signal.*

3. Micro-sensors have been around for many, many years especially in fields such as consumer products. Cars, computers, cameras, cell phones, and home appliances all have micro-sensors. What particular field (e.g., civil engineering, biomedical, aerospace) do you see as having endless possibilities for the use of micro-sized sensors? Discuss some of these possibilities.

*Answers will vary.*

4. Identify at least five types of sensors found in your car and explain what each sensor senses.

*Most cars today have over 100 micro-sized sensors. Types of senses found in cars are pressure sensors (tire pressure, passenger weight), flow sensors (intake manifold flowrates), accelerometers (airbag deployment sensor), thermal sensors (engine temperature, atmospheric temperature inside and outside of the car), moisture sensors (windshield wiper activation), tilt sensors (side airbag actuation)*

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