Micropumps Overview Knowledge Probe
Instructor Guide

Notes to Instructor

The Knowledge Probe (KP) is a pre-test for the *Micropumps Overview Learning Module*. This KP should be given before starting the *Micropumps Overview Learning Module*. This will enable you to determine the participants' current knowledge of micropumps and their operations. The Final Assessment addresses the same concepts as the KP; therefore, you can determine the learning that took place as a result of this learning module.

Following is a list of the units included in the *Micropumps Overview Learning Module*.

- **Micropumps Knowledge Probe (KP) - Pretest**
- Micropumps Overview Primary Knowledge
- Diaphragm Pump Activity
- Capillary Action Activity
- Micropumps Overview Final Assessment

Description

The purpose of Micropump learning module is to introduce you to the types and operations of micro and nano-sized pumps, their applications, and their differences and similarities with macro-sized pumps. Activities allow for further discoveries into the operation of micropumps. This knowledge probe helps determine your *current* knowledge of macro and micro-sized pumps and their operations and to identify areas on which you need to concentrate.

Answer each of the following questions to the best of your knowledge.

1. Which of the following BEST describes the principle of fluid flow? Fluids flow…
   a. from high elevations to lower elevations
   b. when enough pressure is reduced on the output
   c. from high pressure to lower pressure areas
   d. with some type of mechanical assistance

2. Micropumps use electrostatically actuated membranes to
   a. open and close channels within the pump, directing the fluid.
   b. increase the temperature of the fluid as it passes the membrane
   c. increase and decrease the pressure in a fluid chamber/channel
   d. actuate the mechanical check valves within the pump

3. What is the fluidic principle that allows fluid to flow through micro-sized channels with no mechanical assistance?
   a. Coriolis effect
   b. Capillary action
   c. Coandă effect
   d. Fluid amplification

4. Which of the following is an example of a non-mechanical micropump?
   a. Bubblejet printhead
   b. Subcutaneous insulin pump
   c. Lab-on-a-chip
   d. Diaphragm pump

5. Which of the following micropumps is used by the microelectronics industry to cool computer chips?
   a. Diaphragm pump
   b. Piezoelectric Actuated Membrane pump
   c. Bubblejet pumps
   d. Microscale Ion Driven Airflow pump

6. The "bubbles" in Bubblejet printheads are created by
   a. actuating a piezoelectric crystal
   b. turning on a micro-sized heater
   c. pulling up on a diaphragm
   d. injecting air into a microchannel

7. An alternating electric charge across a piezoelectric crystal will cause it to _____ (choose the BEST answer)
   a. deform.
   b. stretch.
   c. vibrate.
   d. shrink.

8. Which of the following diameters would yield the fastest flow rate due to capillary action?
   a. 100 millimeters
   b. 10 millimeters
   c. 100 micrometers
   d. 10 micrometers

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program through Grants. For more learning modules related to microtechnology, visit the SCME website (http://scme-nm.org).