

**Southwest Center for Microsystems Education (SCME)  
University of New Mexico**

# **Micropumps Overview Learning Module**

This learning module contains 5 units:

Knowledge Probe (Pre-test)  
Micropumps Overview Primary Knowledge (PK)  
Diaphragm Pump Activity  
Capillary Action Activity  
Final Assessment

*This learning module introduces the micropump, how it works and where it is used in microtechnology. Activities allow for further discovery into the operation of micropumps.*

Target audiences: High School, Community College, University

Made possible through grants from the National Science Foundation Department of Undergraduate Education #0830384, 0902411, and 1205138.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and creators, and do not necessarily reflect the views of the National Science Foundation.

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Website: [www.scme-nm.org](http://www.scme-nm.org)

# Micropumps Overview Knowledge Probe

## Participant Guide

### Description

The purpose of Micropump Overview 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 exploration into how micropumps work. 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>).*