

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

History of MEMS Learning Module

This booklet contains five (5) units:
History of MEMS Knowledge Probe (KP)
History of MEMS Primary Knowledge (PK)
Activity: History of MEMS
Activity: New Innovations in MEMS
Final Assessment

This learning module provides a timeline of the progression of microtechnology through a series of innovations that starts with the first Point Contact Transistor built in 1947 and ends with the optical network switch in 1999. Activities provide the opportunity to build on this timeline and to identify innovations of the 21st century that have contributed to current advancements in both micro and nanotechnology.

Target audiences: High School, Community College, University

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Website: www.scme-nm.org

History of MEMS

Knowledge Probe (Pre-Quiz)

Participant Guide

Introduction

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This Knowledge Probe (pre-quiz) helps to determine your current knowledge of the history of MEMS prior to completing the History of MEMS Learning Module and its related activities. Answer the following questions to the best of your knowledge.

There are 15 questions.

1. Which of the following events is associated with Dr. Richard Feynman?
 - a. Invention of the germanium transistor
 - b. “There’s Plenty of Room at the Bottom” speech
 - c. Resonant gate transistor patent
 - d. Design of the integrated pressure sensor
2. The 1954 discovery of the piezoresistive effect in silicon made which of the following possible?
 - a. Polysilicon structures as electronic components
 - b. Polysilicon structural layers as insulating layers
 - c. Silicon substrates as thermoelectric components
 - d. Bulk etching into silicon substrates
3. The following MEMS structure was manufactured using which of these micromachining processes?
 - a. Surface
 - b. Bulk
 - c. LIGA
 - d. SCREAM



4. The invention of the _____ in 1986 allowed us to “see” the topography of an atomic structure.
 - a. The microscope
 - b. Scanning electron microscope
 - c. Tunneling microscope
 - d. Atomic Force microscope

5. HP micromachined the first _____ in 1979, a device used in both commercial and personal products.
 - a. Resonant gate transistor
 - b. Ink-jet nozzle
 - c. Crash or inertial sensor
 - d. Electrostatic drive motors

6. In 1958, one of the first _____ was built by Jack Kilby from Texas Instruments and it consisted of one transistor, three resistors, and one capacitor.
 - a. Resonant gate transistor
 - b. Crash or inertial sensor
 - c. Integrated circuit
 - d. Electrostatic sensor

7. Dr. Feynman felt that lubrication would most likely NOT be an issue for components in the micro-scale due to _____ in the micro-scale.
 - a. minimal force and rapid heat loss
 - b. the types of forces
 - c. the interactive forces
 - d. the lack of inertia and friction

8. Which of the following is NOT a micromachining method?
 - a. Bulk
 - b. Surface
 - c. MOEMS
 - d. LIGA

9. Which of the following was the first batch fabricated MEMS device?
 - a. Inkjet nozzle
 - b. Resonant gate transistor
 - c. Optical switch
 - d. Integrated circuit

10. Van der Waals attraction is the attraction between
 - a. Molecules and atoms
 - b. Atoms and surfaces
 - c. Molecules and surfaces
 - d. Molecules, atoms and surfaces

11. Which of the following challenges was NOT made by Dr. Feynman to encourage the exploration of “small” technology?
- Putting the information from a page of a book on an area $1/25,000$ smaller in linear scale
 - Fabricating an internal combustion engine that would fit on the head of a pin
 - Making an operating electric motor which fits inside a $1/64$ inch cube
12. Electrochemical anisotropic etching is important in microsystems fabrication because it is the basis of the _____ micromachining process.
- Bulk
 - Surface
 - MOEMS
 - LIGA
13. The micromachining process that allows for the fabrication of high aspect ratio devices as high as 100:1, is called
- Bulk
 - Surface
 - MOEMS
 - LIGA
14. In 1994, Bosch, a German company, developed the “Bosch process” that is used in _____ processes.
- Bulk
 - Isotropic
 - RIE
 - DRIE
15. In 1999 Lucent Technologies developed the first micro-sized _____ enabling the advancement of data communication.
- Integrated mechanical switch
 - Resonant gate switch
 - Optical network switch
 - Electrostatic network switch

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