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## ***The Magic of Ceramics -- Study Guide, Chapter 14***

1. Compare the size of a nanometer, an Angstrom, and a typical atom.
2. What are some reasons that building a material at the nanoscale might result in unique and improved properties?
3. How are nanoparticles synthesized?
4. Fine particles tend to agglomerate into grape-like clusters that are very difficult to compact into close-packed arrangements. Describe two ways to overcome this.
5. What is biomimetics?
6. Explain how silicon carbide single crystal whiskers are grown by the VLS process.
7. Describe how gold was used as a catalyst to grow an oriented array of ZnO nanowires.
8. Describe hydrothermal synthesis of nanorods of ZnO.
9. What is the key difference between a diamond structure and a graphite structure? How does this result in the enormous difference in behavior/properties of these two pure carbon materials?
10. What is graphene?
11. What is a carbon nanotube?
12. What is an atomic force microscope (AFM) and how do ceramics make it possible?

13. Describe the integrated circuit chip that first made the hand-held calculator possible in 1971.
14. Describe the integrated circuit chip that made the microprocessor (Central Processing Unit or CPU) in 1979 that made hard drives, printers, and modems possible.
15. Describe the integrated circuit chip in 1992 that made possible the notebook computer.
16. By 2008, how many transistors could be built into a single chip?
17. How was the technology to miniaturize IC chips applied to flash memories?
18. Compare the memory storage of a 1980 flash memory with that of a 2008 flash memory.
19. What is a charge-coupled device?
20. Compare the capability of a CCD digital image in 1971 to that in 2010.
21. Explain the importance of glass technology to the digital electronics revolution.
22. What is Gorilla Glass?
23. All of these ceramics advances made our miniaturized cell phone possible. After reading all the chapters of *The Magic of Ceramics*, can you now list all of the ceramic technologies in your cell phone?