Exploring the Nanoworld

Name _____
Date _____ Hour ___

As you work through the kit, *Exploring the Nanoworld*, answer the following questions completely.

1. What does the term nanoworld mean?

2. a.) Using scientific notation write one thousandth.

   b.) Now square that number.

   c.) What number do you have?

   d.) Now cube one thousandth.

   e.) What number do you now have?

3. What does the abbreviation LED stand for and what is an LED?

4. Why are LEDs replacing standard white incandescent lamps in traffic lights? Give at least three reasons.

5. Sketch and label the parts of an LED.

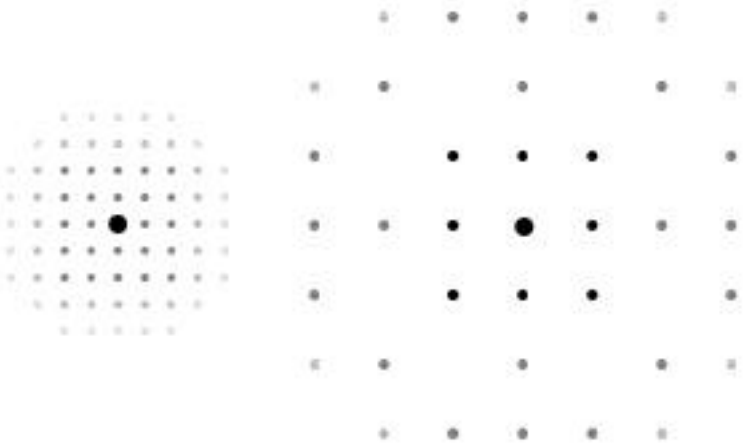
6. Explain the energy transformation that occurs in the LED.

7. Another name for a micrometer is _____. How big is it?

8. How do we indirectly “see” the arrangement of individual atoms in the nanoworld?

9. What features do you see on the diffraction slide and what do these features represent?

10. Looking at the two diffraction patterns below, explain which one displays spots that are further apart.



11. If you looked through the diffraction grating at a different color LED, what would you see? Explain.

12. Looking at the two pictures on page 12, what relationship exists between them?

13. What does Scanning Probe Microscopy (SPM) allow you to do?

14. Using the refrigerator magnet, what do you observe when the probe strip is moved horizontally? Vertically?

    Horizontally:

    Vertically:

15. Draw the three possibilities for the placement of the magnetic fields. Under each picture explain what would happen to the probe strip as you move it across the surface.

Up or Down

Up or Down

Up or Down

Left or Right

Left or Right

Left or Right

16. Explain how a probe tip works to detect atoms.

17. Name two uses for the atom-sized tips used in Scanning Probe Microscopy.

18. Why is carbon commonly used to make probe tips?

19. What is a “smart material”?

20. The memory metal you examined in this kit, an example of one type of smart material, is composed of

    _____ and _____.

21. To what does the term "atomic ballet" refer?

22. How do we know that the atoms in memory metal move?

23. Name at least three uses of memory metal.

24. What is DNA and how was its structural determination accomplished?

25. How do the diffraction patterns of a single and a double helix differ?

26. How might the ability to “pick and place” groups of atoms change our future?

27. Where can LEDs be found today? Give at least three examples.

28. What is a fiber optic?

29. What can be accomplished when light from a diode laser is combined with a fiber optic?

30. Why is blue laser light capable of reading smaller features than red laser light?

31. Why is blue laser light's capability of reading smaller features important?

32. What creates the different colors that LEDs emit?

33. Explain how giant billboards and video screens can change their messages or be animated.

34. From the *field guide to the nanoworld* list, enumerate the technologies you have encountered and where you found them. Within the next few days, see if you can add to that list.