Memory Metal Assessment

Name	
Date	Hour

Matching

Match the word with the best definition.

 1. austenite	a. a pattern that can be shifted repeatedly to create the entire structure of atoms in a crystal
 2. martensite	b. a solid solution composed of two or more metals
 3. transition temperature	c. alloy containing nearly equal amounts of nickel and titanium
 4. Nitinol	d. a physical state of matter
 5. alloy	e. a type of unit cell
 6. smart material	f. a substance that can respond to stimuli in its environment
 7. density	g. high temperature phase
 8. unit cell	h. low temperature phase
 9. coordination number	i. the temperature at which a phase transformation occurs
 10. body-centered cubic	j. mass per unit volume
 11. phase	k. number of nearest neighbors
 12. LeChatelier's Principle	1. when a system at equilibrium experiences a stress, the equilibrium shifts partially to relieve that stress partially
	m. the temperature at which martensite melts

Multiple Choice

Choose the best answer.

 13. In the high-temperature phase of NiTi, the coordination numbers of the N and Ti are a. 6 for Ni and 6 for Ti b. 6 for Ni and 8 for Ti c. 8 for Ni and 6 for Ti d. 8 for Ni and 8 for Ti 	Ji
14. What technique lets us determine the atomic positions in NiTi memory metal both before and after the solid has undergone its phase change? a. spectroscopy with visible light b. measurement of specific heat c. electrical resistivity d. x-ray diffraction	
a. less symmetrical than martensite b. more rigid than martensite c. more flexible than martensite d. both a and c	
16. At room temperature Nitinol can exist in either of two structures, which are dependent upon a. the mass of the sample. b. the exact ratio of Ni to Ti. c. the length of the sample. d. the diameter of the rod.	
17. In some phase changes like that of ice and water, there is a noticeable change; however, there is no visible phase change between austenite and martensite because a. it only occurs at the atomic level. b. only two atoms exchange places. c. the structures are the same d. the temperature is too high e. no phase change occurs.	l

Problems

18. Using figure 9.10 put this figure in, what compositions of Ni_xTi_{1-x} would you choose so as to have two

samples, one of which is in the low-temperature phase at $0\,^{\circ}$ C, with the other in the high temperature phase at this same temperature. How could you tell them apart without chemical analysis?

19.	Design a sculpture made of memory metal that will change its shape using electricity. Why can this be done?
20.	When a thin straight wire of NiTi memory metal in the low-temperature phase is bent and placed in a concentrated solution of bromine in wet methanol, it straightens out
	as it dissolves. Why?
21.	Since NiTi memory metal is biocompatible, it has been proposed that it could be inserted into arteries to help unclog them. Given that the metal is to be coiled like a spring in one phase and straight in the other, how is the experiment carried out?
22.	Why do purely solid-state phase changes like that exhibited by NiTi memory metal often
	involve enthalpies of only a few kilojoules of energy per mole compared to values like 40 kl to vaporize a mole of water?