

Name:

Date:

Class:

## Investigations of Nitinol – Student Guide

### Demonstration: Observations and Inferences

What are some things you notice about the demonstration? What is changing in the situation? (Be careful not to confuse what you see and observe with what you think is causing the changes.)

Observation 1:

Observation 2:

What do you think is causing the changes you see in the situation? What inferences can you make about the situation? What might be some of the causes of the observations you are making about the situation?

Inference 1:

Inference 2:

Make a list of questions you have about the situation you have observed. What do you wonder about the situation? What do you wonder about the possible applications of the situation?

Wonder question 1:

Wonder question 2:

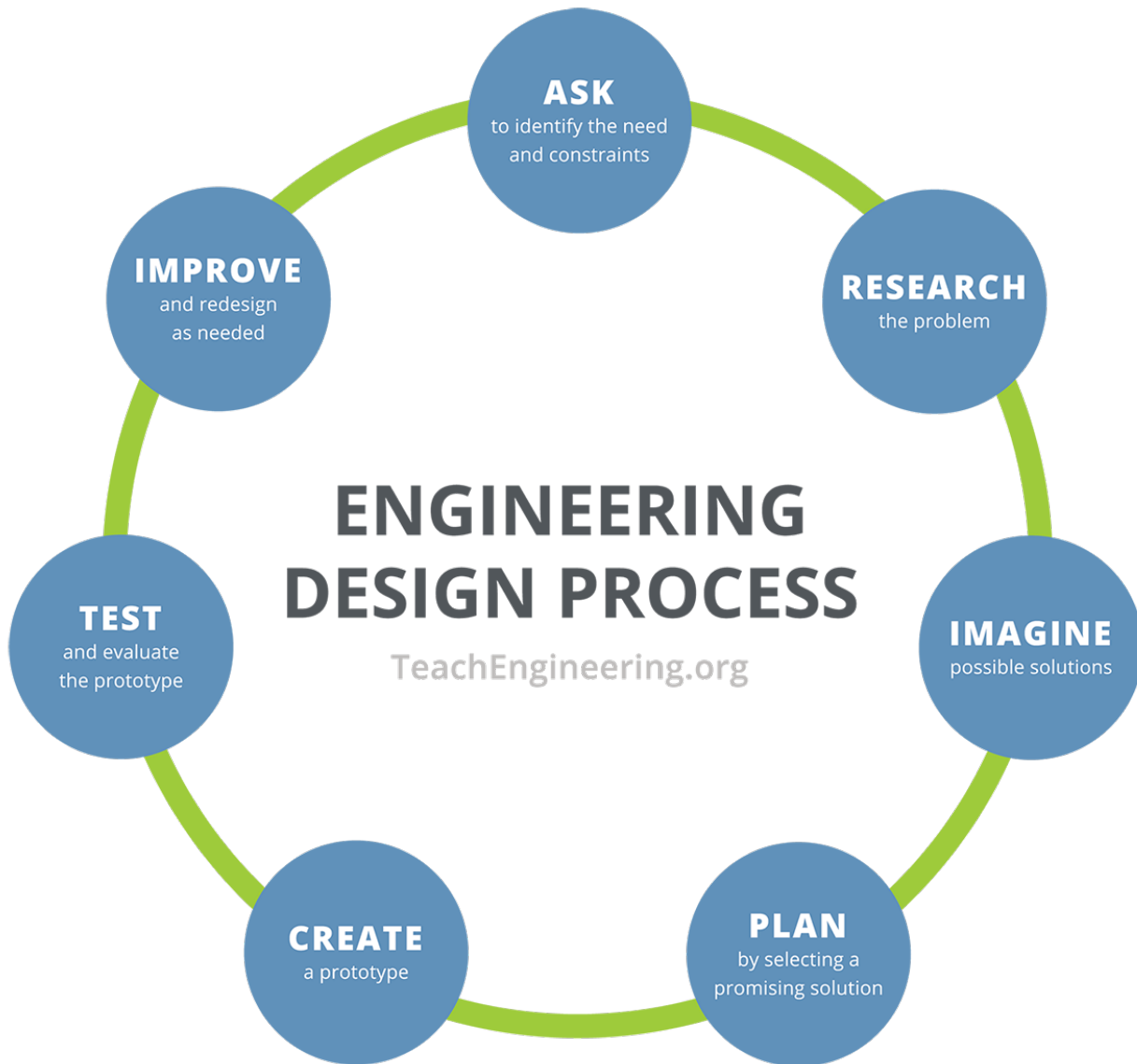
Wonder question 3:

Name:

Date:

Class:

**Engineering Design Process**



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

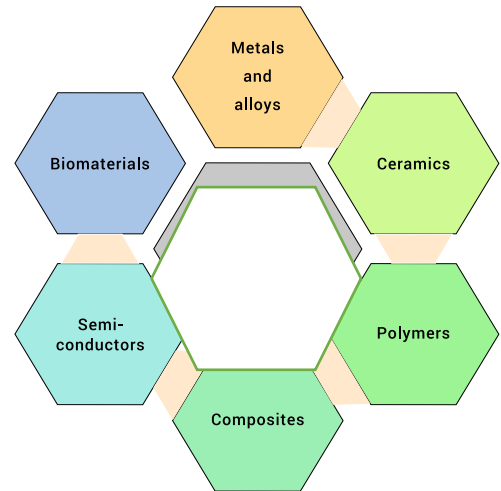
### Research

**Instructions:** Complete the following notes, diagrams, and discussion prompts as your teacher goes through the background slides for the activity.

### Materials Science and Engineering

\_\_\_\_\_ work in an interdisciplinary field discovering new materials and understanding their \_\_\_\_\_.

\_\_\_\_\_ work to find \_\_\_\_\_ for materials in other fields and industries.



### Thinking Like an Engineer

Engineers use a general process to \_\_\_\_\_ and \_\_\_\_\_.

This process is called the engineering design process, and it includes the following steps:

1. \_\_\_\_\_ the problem
2. \_\_\_\_\_ the problem
3. \_\_\_\_\_ solutions
4. \_\_\_\_\_ a solution
5. Create a \_\_\_\_\_ design
6. Test and \_\_\_\_\_ the prototype
7. \_\_\_\_\_ design as needed

This process can repeat over and over because the goal is the \_\_\_\_\_ possible solution!

### Background Information

**Instructions:** Complete the following chart to answer the questions about metals and nonmetals.

Type	Elements	Properties	Location on P. Table
<i>Metals</i>			
<i>Nonmetals</i>			

Name:

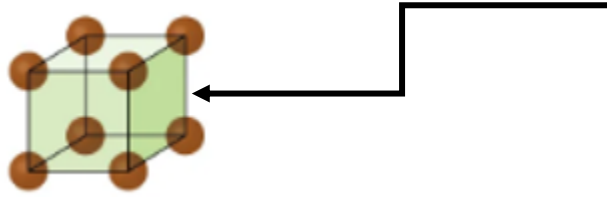
Date:

Class:

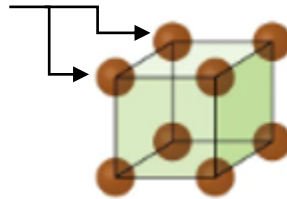
### Structure of Metals and Nonmetals

**Instructions:** Complete the following as your teacher goes through the background slides.

Metals have a specific \_\_\_\_\_ micro-structure called a \_\_\_\_\_.



Unit cells have \_\_\_\_\_ that show the position of each of the atoms.



One type of unit cell pattern is called a \_\_\_\_\_.

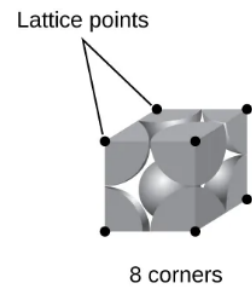
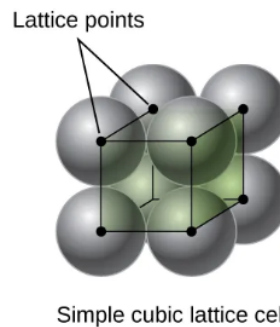
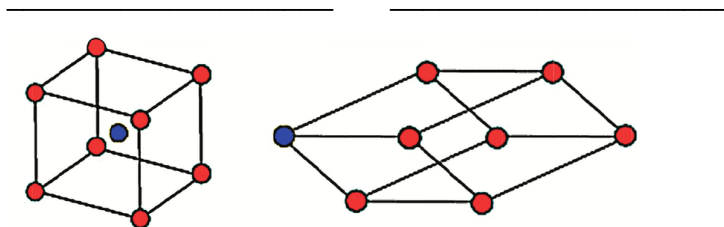


Figure 10.49 A simple cubic lattice unit cell contains one-eighth of an atom at each of its eight corners, so it contains one atom total.

### Structure of Nitinol (NiTi)

The \_\_\_\_\_ changes in the shape of NiTi are due to \_\_\_\_\_ changes in its \_\_\_\_\_.

The NiTi structure starts as a \_\_\_\_\_ called \_\_\_\_\_ and changes to a \_\_\_\_\_ structure called \_\_\_\_\_.



Name:

Date:

Class:

## Imagine

Brainstorm as many ideas as you can for a device you want to create. Remember: There are no bad or crazy ideas!

Name:

Date:

Class:

### Plan

Have each team member share their ideas. As a team, select ONE solution. This can be one specific solution or a mixture of ideas. Draw your team's solution in the box below. Make sure to label parts and materials to be used.

**Create** – Build your prototype as shown in your group's drawings.

Name:

Date:

Class:

**Test** – Test your design and then answer the following questions.

What worked in your design, and why?

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What did not work in your design, and why?

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**Improve** – Based on your testing and results, how would you improve your design? Why?

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Name:

Date:

Class:

### Whiteboard Meeting Notes

Record the following from the board meeting:

1. A difficulty a group encountered, and how they worked through it.
2. A sketch of another group's design or experiment.
3. Four words, phrases, or images other groups used that explained their design or experiment well.
4. Other miscellaneous notes: