**Chapter Questions for “Napoleon’s Buttons”**

**Chapter 4: Cellulose**

1. How did the demand for cheap cotton lead to many different mechanical innovations?
2. What role did cotton play in improving factory conditions and child labor laws?
3. How did the cotton trade lead to an increased demand in skilled laborers such as engineers, mechanics, and chemists?
4. What agricultural innovations were the products of cotton farming?
5. Define polymer. Cellulose is a polymer of what? Where is it found? What does it do?
6. Explain the chemistry behind the statement, “Cotton breathes.”
7. Compare and contrast chitin and cellulose.
8. Why can cows, horses, and other herbivores obtain all of their necessary glucose from grazing, but humans cannot? Are there any benefits to humans eating plants?
9. Which polymers of glucose can humans digest? What is the structural difference between these polymers and indigestible cellulose?
10. Why do cooks use starch sources as thickeners?
11. Why do animals have to store their excess glucose as glycogen instead of amylopectin (found in plants)?
12. What is guncotton? How was it formed?

**Chapter 5: Nitro Compounds**

1. What is the molecular composition of a nitro compound?
2. What are the three main components of gunpowder? Where did gunpowder originate?
3. What is significant about the changes in physical state that occur in the chemical reaction for the explosion of gunpowder?
4. Why did it become necessary to have powder that would burn at different rates? How was this need met?
5. The product of the explosion of gunpowder includes an N2 molecule. Contrast the stability of this molecule with the reactants that produce it. The production of this molecule is what type of reaction? How do we know?
6. Why do explosive reactions have to occur rapidly in order to be explosive?
7. Why is the oxygen atom in the nitro compound necessary to give it its explosive qualities?
8. What is the full name of TNT? How many nitro groups are attached to it?
9. Who is Ascanio Sobrero? What did he discover? How is this compound used in medicine today?
10. As a molecule, how stable is nitroglycerin? What is needed to cause nitroglycerine to explode?
11. Explain Alfred Nobel’s invention of dynamite, including the incidents that led up to the need to stabilize the nitroglycerine compound.
12. Explain the advantages of using TNT in heavy artillery as opposed to picric acid.
13. Who is Fritz Haber? Why was his work so important to Germany’s war efforts? What did he discover? Why was there protest over his receiving the Nobel Prize for chemistry?
14. How has ammonium nitrate been used in recent history? What makes it popular with terrorist groups?

**Chapter 6: Silk and Nylon**

1. What characteristics of the silk molecule give silk its shine, smooth texture, and sparkle?
2. What characteristics of the silk molecule make it very easy to dye?
3. Modern chemists can make synthetic silk in laboratories. Why is this not a feasible solution to the high demand for silk fabrics?
4. What is the chemical difference between the words synthetic and artificial?
5. What was the main problem with Chardonnet’s artificial silk? What was the main problem with rayon?
6. How does nylon differ from silk on a molecular level?
7. Besides women’s hosiery, where else did nylon find a market?

**Chapter 7: Phenol**

1. What is the “miasma theory” and why did it seem to be a reasonable explanation for the spread of germs in the mid-1800’s?
2. Both Louis Pasteur and Joseph Lister had the same theory for the spread of disease. What was this theory?
3. How did Lister apply his theory as a surgeon? What were some of the positive outcomes? Negative outcomes?
4. What was the impetus for the use of phenol in plastics?
5. Who initiated the “Age of Plastics”? How?
6. Where does shellac come from?
7. What was the advantage of the replacement of shellac with Bakelite?
8. What is a thermoset material?
9. Why was Bakelite an appropriate replacement for ivory in billiard balls?
10. Where does synthetic vanilla come from? Why was there a need for synthetic vanillin?
11. What is lignin? Where is it found? What makes lignin so rigid? What is the difference between synthetic vanillin and vanillin derived from the vanilla bean?
12. How is synthetic vanilla connected to the phenol molecule?