



Introduction to Food Science: An Overview  
Food Science Course 1  
Hints and Grading Guide for Essay Questions

**Note: Some questions don't lend themselves to hints, as a result this guide is not comprehensive**

**Chapter 1 – Food Science Basics**

The assignments are self-explanatory.

**Chapter 2 – A Science Primer**

**What Do You Think?**

We have just scratched the surface of what there is to learn, in my opinion.

**Journaling Idea**

“How” comes from careful scientific observations and the rules we generate from them that describe nature around us. “Why” is something we can't answer. For example, as my chemistry professor, we have observed electrons in different energy states interact, but we have no idea why. He jokingly indicated that for all we know the electrons love each other. I think you get the idea.

**Chapter Review**

This is a real problem in science, and this has happened time and again. In the food industry it can and has happened very easily. That's why in processes where it counts prepackaged, already portioned ingredients are used wherever possible.

**Chapter 3 – Food Processing**

**What Do You Think?**

5. A great example is to look up a food trend you have heard about, such as “trans fats”, and find articles that talk about present different aspects. NEVER assume that one article, REGARDLESS OF THE SOURCE, holds the truth on the matter. Unfortunately in today's world, author bias must be assumed, and it can be hidden, so it falls on the individual to make sure they aren't led down a path their own wisdom and reasoning would not lead them. You have the intelligence to come up with your own well-reasoned, well researched opinions.

## **Chapter 4 – Food Processing**

### **Chapter Review**

1. Knowing approximately the amount of macro food components you are eating, including carbohydrates, protein, fat, and further if the carbohydrates are sugars or starch, combined with the recommended intake of these things, can help you understand if adjustment is needed. If you have health concerns, the side panel can also help you avoid things that are currently understood to be harmful for certain conditions. An example is sodium intake and those afflicted with high blood pressure.
2. Correspondence with a food manufacturer could help you learn what is in a purchased food you enjoy or want to consume.

## **Chapter 5 - Water**

### **What Do You Think?**

I can't.

### **Journaling Idea**

Have fun with this assignment. Water is so important to all life, thinking about how to preserve it, even in cooking, can be fun. For example, using a lid, or a hood that will condense water vapor.

### **Chapter Review Questions**

1. The ground will freeze if the weather is cold enough, but only to a certain depth. When water freezes in the ground, ice expands, causing the ground to shift. Footings must be below the “frost line” where the ground will freeze, otherwise buildings will shift and crack. Hydrogen bonding is amazingly strong.
2. There could be a couple valid answers here. Keeping ice crystals small as they are forming requires skill and equipment. For a finished ice cream, keeping them small in a freezer over time is a bigger challenge. Ingredients that can be used to “stabilize” the ice cream, preventing ice crystals from getting too large, are important.
3. They are. Anything in a solid state is “frozen”, although usually only water is spoken of as being ice in this state. The solid can be different states, which is beyond this course.
4. Hydrogen bonds. It is how water holds together.

## **Chapter 6 - Carbohydrates**

### **What Do You Think?**

Modified food starch can play many roles, usually to help preserve desired textural characteristics longer than an unmodified starch would allow.

### **Journaling Idea**

Most peoples favorite “carbohydrate molecule” is a sugar of some kind. Sucrose is the most common as it is table sugar and is important in desserts.

### **Chapter Review Questions**

1. Cornstarch is made up of amylose and amylopectin, large polymers. Plastic is also made of polymers. Edible films are used for some types of packaging and are made of plant polymers.
2. This was a bit of fun, although I should probably have put the “goal” part first. The first part is a little scary!
3. Choose a food and use your proximate analysis skills to pick it apart.
4. This is a bit of a trick question. There is no area of your life that doesn’t involve chemistry in some way. Your physical body is 100% chemicals, and chemical processes are what keep you alive.

### **Chapter 7 – Proteins**

#### **What Do You Think?**

These questions are somewhat rhetorical, meaning I don’t really expect that the student can answer them all right now. They are designed to get you thinking. There is much to learn about proteins and how they interact to become a good food scientist.

### **Journaling Idea**

Eggs are prepared in innumerable ways. Depending on the experience of the cook consulted it can be a long or short list. The student should be able to understand and explain how different processing techniques affect even the same starting protein ingredients, including eggs and especially egg whites. Examples: Whipping into a foam and then baking or just cracking an egg into a hot pan into a hot pan result in quite different finished foods. Whipping denatures the white through mechanical action prior to baking, whereas frying denatures the white and sets the structure through heat, without mechanical action.

### **Chapter Review Questions**

1. The favorite protein source will be student dependent. Example: dry roasted beef. As the beef cooks the collagen fibers (a protein) denature and if cooked long enough become gelatin like. The result is fully cooked muscle fibers that are fall-apart tender since collagen is what holds them together.
2. Cattle and other ruminant animals can live solely on limited plants, such as grass, through fermentation that happens in an additional stomach. Humans can’t do this, but with careful selection are able to get most needed proteins needed through plants and plant products as well.

3. I give this one away in the hint. Proteins are integral to life, all the way down to the cellular level. If cellular proteins cease to function and can't be replaced, the organism, large or small, will shortly die. This is a primary reason why radiation "poisoning" can be lethal if it is of the right type and duration.
4. Protein denaturation plays a role in almost every food using proteins. Egg whites, whole or ground muscle foods, and milk proteins when making cheeses or yogurts are all examples.
5. The amino acid sequences are different, but these are all examples of proteins.

## **Chapter 8 – Fats**

### **Journaling Idea**

Proximate analysis refers to breaking the food down into its component parts: carbohydrates, proteins, fats, water, and ash. The student should be able to break down their favorite food into percentages of these five components. Ideas on how to change the amounts of ingredients will depend on their creativity, and at this point I wouldn't expect too much, but want to get them thinking.

### **Chapter Review Questions**

1. I make the point in the text that science is never settled but continues to change with new experimentation and understanding.
2. The text references experiences I had working in different countries. Language skills can help significantly. The same is true for other professions, although in different ways.
3. A donut fried in room temperature liquid fat would be oily and have a mouthfeel most would find unpleasant. If you were to squeeze the donut, oil would be visible to some degree, like squeezing a sponge. Room temperature solid fat won't do this.
4. The mouthfeel of cheap chocolates with a higher melting point feel waxy in the mouth. A way to mimic this is to suck on a piece of ice, then put a piece of normal chocolate in your mouth. The mouthfeel is unpleasant.
5. "Good source" is a United States FDA term meaning the food contains at least 10% of the recommended amount of the nutrient. New foods can be developed for customers looking for a certain nutrient.
6. For example, I worked on Cream of Wheat, fortifying it with calcium and iron to the "excellent source" level. Gluten free foods. Good source of calcium macaroni and cheese. Fatty ingredients might reduce the shelf life due to oxidative rancidity. High sugar content foods can absorb moisture readily. Packaging can help slow down moisture transmission and rancidity reactions. These are just examples.
7. Completely up to the student.
8. Determining why an experiment doesn't work can be some of the best education. I do reference the most common reasons for failure in the discussion portions.
9. Butter has naturally occurring sugar (lactose) and protein present in cream.

10. Creating sometimes complex spreadsheets were an almost daily activity during my profession. Statistics calculations, while mostly accomplished through software, needed to be understood as well.

**Bonus Section**

The answers to these questions depend on the student and their chosen university's website.