1.1: Where are we Headed?

> This page is a draft and is under active development.

In This Chapter

We begin Chapter 1 talking about some familiar phenomena such as phase and temperature changes of pure substances and chemical reactions. The *Energy-Interaction Model* which describes the idea of energy conservation is universal and can be applied to a wide range of phenomena and interactions. So why start with what might seem to be some run-of-the-mill stuff you already know a lot about?

- Reason (1) is you do know a lot about this phenomena, so you are not hit right off the bat with stuff you don't know anything about.
- Reason (2) is that there are some very interesting parts of thermal phenomena that you probably cannot make much sense of right now. And it is fun to finally be able to explain phenomena that you observe on a daily basis.

We will also see that by applying the Energy-Interaction Model to some very strange thermal phenomena, we can make sense of them, we can explain what is going on, and we can answer all kinds of questions about the phenomena. To see the universal applicability of the Energy-Interaction Model, we will also apply this model to several chemical reactions.

One rather simple kind of thermal phenomena you will immediately encounter in this course involves the addition or removal of energy as heat from pure substances. You have encountered this general class of phenomena (changing the temperature of a substance and/or causing it to go through a phase change) in general physical science courses as well as in your chemistry courses. So partly as review, but also as an example of how models need to be extended and modified, we introduce the *Three-Phase Model of Pure Substances* in this chapter. In the next section, we will describe the general structure of the *Energy-Interaction Model* and show how it can be used together with the *Three-Phase Model of Pure Substances.*

In the following section, we will also present some of the kinds of questions we will want to be able to answer, the kinds of explanations we will want to construct, and the kinds of predictions we can make using the models presented in the chapter. We will use a helpful tool, *Energy-Interaction Diagrams*, which was developed specifically for this course in order to help students make sense of energy conservation. As we do this throughout the course, we will become much more aware of the limitations on the kinds of questions and explanations that the particular models, in this case, the *Energy-Interaction Model* can help us with. We will begin to get a much better feeling for when we can *take an energy conservation approach*, i.e., apply the *Energy-Interaction Model* and when we must use a different model.

Keep in mind that in Chapter 1 we deliberately restrict the range of phenomena to which we are applying the *Energy-Interaction Model* to mostly thermal phenomena (and a few examples of chemical reactions). We will wait until Chapter 2 to apply the *Energy-Interaction Model* to mechanical interactions and processes. It is easy to forget that this is the one model that can be usefully applied to essentially any interaction or process that occurs in any branch of physical and biological science.

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