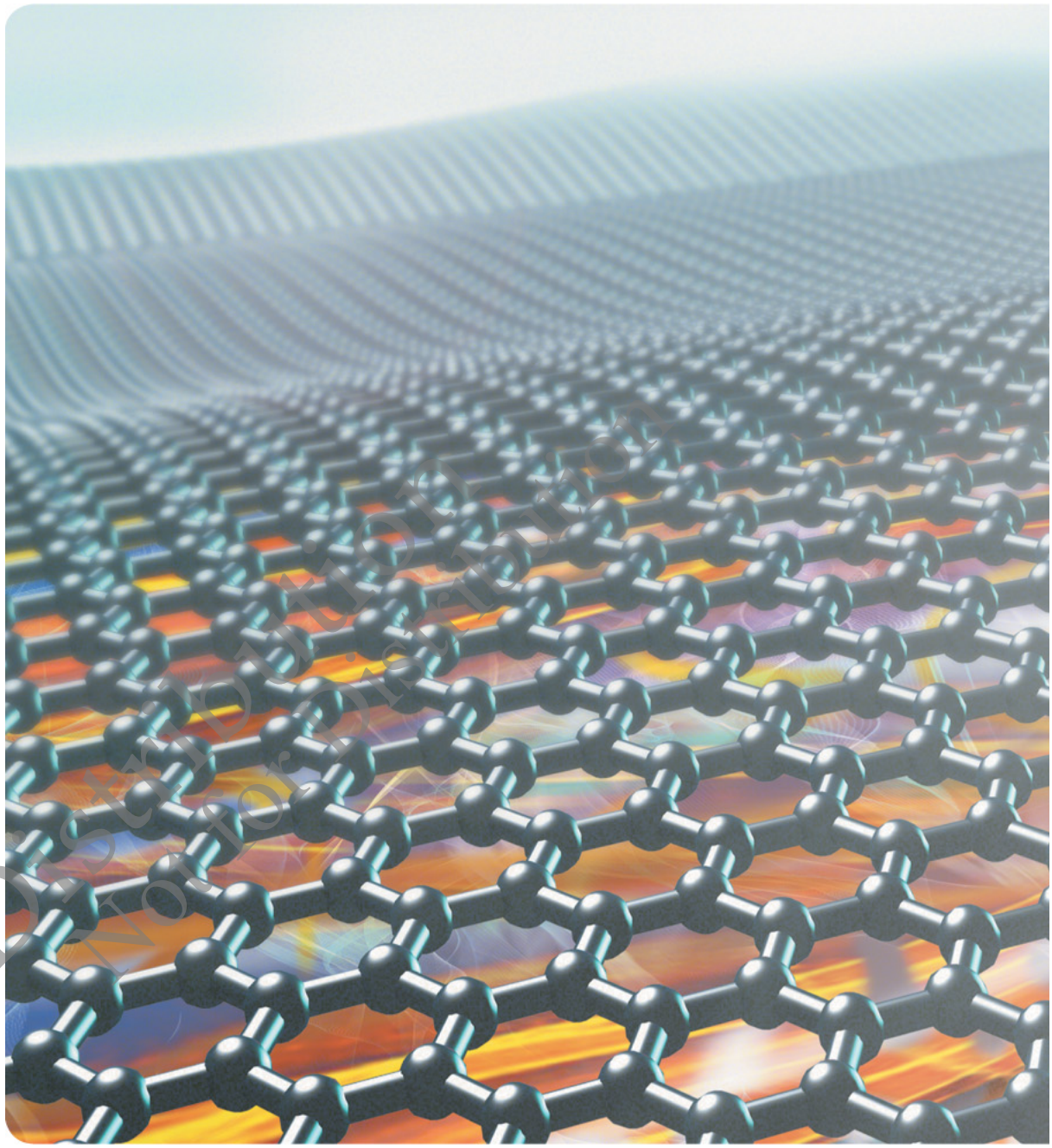
Pearson

Chapter 12
Crystalline Solids and Modern Materials



Graphene is the thinnest material known—it is only one atom thick.

> "One should realise that ideas are never new. However brilliant, every idea is always based on previous knowledge.... This should not be used as excuse for not trying because local circumstances vary.... New technologies offer a reasonable chance that old failed ideas may work unpredictably well the next time round."
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> —*Andre Geim (1958–)*

Learning Outcomes

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IN THIS CHAPTER, WE FOCUS on the solid state of matter. We first examine the structures of solids, keeping in mind that these structures determine the properties of solids. For example, the repeating hexagonal pattern of water molecules in crystalline ice determines the hexagonal shape of a snowflake, and the repeating cubic pattern of sodium and chloride ions in sodium chloride determines the cubic shape of salt grains. In other words, the properties of solids (in this case their shape) are determined by the structure of the particles that compose them. We then turn our attention to the study and development of solids with unique and useful properties, a field known as *materials science*. The ceramics that compose your coffee cups, the semiconductors in your electronic devices, and the plastics that are all around you are materials developed to have specific properties that serve specific purposes. In this chapter, we take a brief look at each of these kinds of materials.