

Chapter 3 Structure of Matter

Structure of Ionic and Molecular Compounds

3. c. *Students know* atoms and molecules form solids by building up repeating patterns, such as the crystal structure of NaCl or long-chain polymers.

Ionic Compounds

Ionic compounds form solids in a characteristic way—they build up repeating patterns of ions. This repeating pattern occurs because each ion is attracted to all the surrounding ions of the opposite charge. The result of all these attractions is a solid with an orderly, three-dimensional arrangement called a **crystal**.

Figure 3–5 shows the structure of a crystal of sodium chloride (NaCl). The diagram shows how equal numbers of Na^+ and Cl^- ions are attracted in an alternating pattern. Each ion is surrounded by oppositely charged ions. The crystal of sodium chloride is shaped like a cube. No matter how large the crystal becomes, it keeps its cubic shape. The crystals of other ionic compounds may have different crystal shapes.

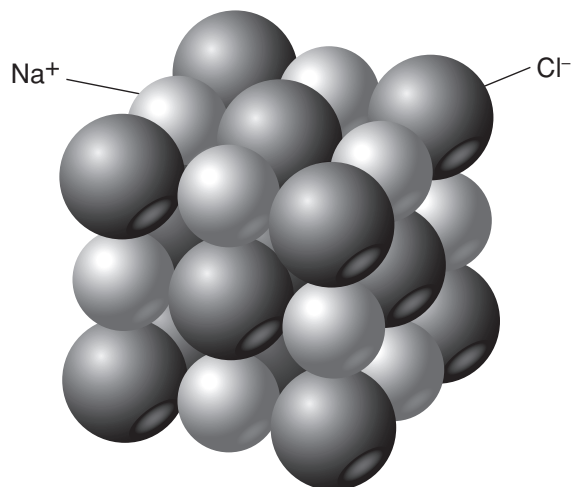


Figure 3–5 NaCl crystal Sodium chloride crystals are cube-shaped.

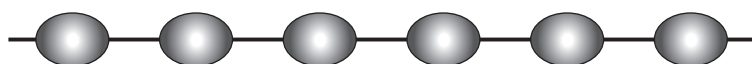
Ionic compounds share some similar properties. Solid ionic compounds are hard and brittle. They have high melting points. When melted or dissolved in water, ionic compounds conduct electric current.

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Molecular Compounds

The molecules of a molecular compound contain atoms that are covalently bonded. Molecular compounds include a vast number of common substances, including water (H_2O), carbon dioxide (CO_2), and methane (CH_4). In general, molecular compounds have low melting points and low boiling points, and they do not conduct electric current. Most familiar compounds that are liquids or gases at room temperature are molecular compounds.

Some molecular compounds are composed of polymers. A **polymer** is a very large molecule made of a chain of many smaller molecules bonded together. The small molecules that make up polymers are called **monomers**. A polymer is often like a string of beads, with many monomers linked together.



Polymer made of one kind of monomer



Polymer made of two kinds of monomers

Figure 3-6 Building polymers Polymers can form from similar or different kinds of monomers.

Many of the molecules that make up living things are polymers. For example, proteins and starches are polymers. DNA molecules, which carry genetic information, are also polymers.

Scientists make many useful polymers in the laboratory. These synthetic polymers include plastics, polyester, and nylon.

Standard 3. c. Check

10 Ionic compounds form solids by building up

- A strings of monomers.
- B repeating patterns of neutral atoms.
- C repeating patterns of ions.
- D repeating patterns of molecules.

11 An ionic compound forms a solid with an orderly, three-dimensional pattern called a(an)

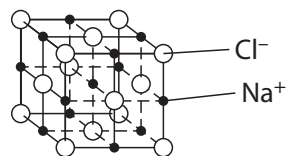
- A monomer.
- B crystal.
- C polymer.
- D ion.

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12 Which is *not* a characteristic of a molecular compound?

- A low melting point
- B does not conduct electric current
- C low boiling point
- D hard, brittle solids at room temperature

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The diagram illustrates the structure of a solid

- A ionic compound.
- B molecular compound.
- C element.
- D polymer.