

Chapter 14

Use with Section 1

ENRICHMENT

● Simple Organic Compounds

Up, Up, and Away . . .

In the 1930s, scientists developed a new chemical that improved a wide variety of products from refrigerators and air conditioners to spray cans. The use of these chemicals, known as chlorofluorocarbons (KLOR oh FLOR oh KAR buhnz), or CFCs, grew rapidly. By 1996, approximately 28.6 billion tons of CFCs were used in \$28 billion worth of products. Hundreds of thousands of people had jobs in the CFC industry. Unfortunately, CFCs turned out to have a serious side effect: It seemed that they were destroying Earth's atmosphere.

Here's what happens:

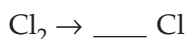
The formula for one CFC is CF_2Cl_2 . When CF_2Cl_2 is released into the atmosphere, it encounters ultraviolet radiation from the sun. That radiation breaks the bonds of the compound, releasing a chlorine molecule. The equation for the reaction is this:



To understand this more clearly, write the total number of atoms involved in the reaction:



Notice that a chlorine molecule is formed. Ultraviolet radiation breaks down that chlorine molecule into individual chlorine atoms. Show what this would look like:



These chlorine atoms float through the atmosphere, ready to bond with whatever is available. In the upper atmosphere, that's usually the ozone molecule: O_3 .



Write the number of atoms: $\underline{\quad} \text{Cl} + \underline{\quad} \text{O} \rightarrow \underline{\quad} \text{Cl} \quad \underline{\quad} \text{O} + \underline{\quad} \text{O}$

At first glance, this reaction looks like a good thing. After all, more oxygen is produced. But ozone is important in Earth's atmosphere. It forms a shield that protects you from the harmful effects of the sun's ultraviolet radiation. That shield is becoming smaller as CFCs linger in the atmosphere.

Answer the following questions, using complete sentences.

By the mid-1990s, nations of the world agreed to stop using CFCs and their relatives, the hydrochlorofluorocarbons (HCFCs), by 2030. You can check their progress in your own neighborhood:

1. Check the labels on chemical products (especially old ones) around your home. Do any contain CFCs or HCFCs? What are they?

2. Although CFCs are being phased out, we need substitutes for them in air conditioners, refrigerators, and aerosols. Investigate to learn what kinds of chemicals are replacing CFCs and create a chart comparing their characteristics.
