**CFCs and the Ozone Layer**

Multiple Choice

1. State what CFC stands for.
2. Chlorofluorocarbon
3. Chinchilla Family Car
4. Charles Family car
5. Chlorofluorocalcium
6. Recall the elements that make up the organic compound known as CFCs.
7. Carbon, chlorine and fluorine
8. Carbon, chlorine and hydrogen
9. Calcium, fluorine and hydrogen
10. Carbon, potassium and potato
11. State what CFCs were mainly used in

Select ALL correct options

1. Solvents
2. Dog food
3. Anaesthetics
4. Refrigeration

Short Answer

1. The ozone layer is thinner over Australia than in most parts of the world.

Explain what impact this has on spending time outdoors in Australia.

1. List at least THREE reasons why CFCs were commonly used as fire-fighting materials, propellants, solvents and refrigerants.
2. Explain how CFCs deplete the ozone layer.

Long Answer

**Read the article below about the success of the Montreal Protocol, then answer the following questions.**

**Why do you think the Montreal Protocol considered to be the most successful climate agreement of all time? Do you think the tactics used to protect and restore the ozone layer could be applied to our current environmental problems?**

**The Montreal Protocol Is the Most Successful Climate Agreement Ever**

Remember the hole in the ozone layer? If you were around in the 80s, you definitely do—it was a climate bogeyman of the time, along with acid rain, and rightfully so.

It was in that decade that scientists confirmed that chemicals called CFCs (found in aerosol cans like hairspray and deodorant) were eating away at the ozone layer, and would produce some scary consequences, from skyrocketing skin cancer rates to damaging effects on plant life and marine ecosystems, if left unchecked.

That realization lit a fire under scientists and, importantly, government officials. (Margaret Thatcher, who trained as a chemist, was among those spooked by it.) In 1987, almost every country in the world signed the Montreal Protocol, agreeing on a plan to phase out damaging CFCs. Consumers bought in, too, voluntarily boycotting the spray cans. As a result of this global effort to get rid of CFCs, scientists now say the ozone layer is slowly healing.

The Montreal Protocol continues to have a huge impact. On Saturday, an amendment was added that will see the phase-out of another potent greenhouse gas, HFCs, used in refrigerators and air conditioners. Although HFCs aren't degrading the ozone layer like CFC's did, they do have 1,000 times the heat-trapping powers of carbon dioxide. Partly driven by growing demand for air conditioners, HFCs are one of the fastest-growing greenhouse gases, increasing at a rate of 10-to-15 percent per year in parts of the world.

This latest agreement is legally binding, and more than 170 countries have signed on.

We've seen some hefty climate summits lately, such as in Paris last year, where countries agreed to work together to limit the increase in global average temperature. That's nothing to sneeze at. But let's take a moment to appreciate the Montreal Protocol, which still isn't necessarily a household name—although it's done nearly 20 times as much for climate protection as the Kyoto Protocol, according to a New York Times op-ed by Durwood Zaelke and Mario Molina. (The latter won a Nobel Prize in 1995 for his work on CFCs in the atmosphere.)

"The Montreal Protocol has done more for climate protection than any other agreement," Zaelke, who is founder and president of the Institute for Governance and Sustainable Development, told me over the phone. Thanks to Montreal, "nearly 100 climate pollutants have been phased out, by nearly 100 percent," he continued.

Manufacturers saw the HFC ban coming, and have been preparing themselves by researching alternatives they'll be able to gradually phase in.

There are lessons to be learned from the Montreal Protocol's success, including the benefit of breaking up climate change, which is often treated as one massive problem, into "more manageable pieces," Zaelke said, "where you can focus on solving that one piece."

**We should look to the Montreal Protocol's latest achievement as a sign of what's possible**

Then there's the fact that the Montreal Protocol deliberately takes developing countries' needs into account, he said. With the new HFC ban, richer nations will phase the chemicals out first, followed by developing ones. Another element of it is that, while the pledges from Paris are voluntary, the Montreal Protocol actually includes trade sanctions—it can punish nations that don't abide by its terms (although it's never been used to do so). These sanctions are only used as a last resort, but they still give the agreement some teeth.

We need to keep working to limit CO2 emissions, but Zaelke also pointed out that a big dent can be made by cutting back on what he calls "short-lived climate pollutants," a category that includes HFCs. Quick mitigation of HFCs and these other pollutants (black carbon, methane, and tropospheric ozone) could avoid 0.6°C of future warming by 2050, and up to 1.5°C by end-of century, he told me. That's significant. So we need to focus on them, too.

This year has seen plenty of bad climate news, from relentlessly hot temperatures to a melting Arctic, extreme drought, and out-of-control wildfire. We should look to the Montreal Protocol's latest achievement as a piece of good news, and a sign of what's possible.

"I am optimistic," Zaelke told me. "When the yogurt finally hits the fan, and world leaders are personally splattered, they're going to turn to us and say, What can I do that's fast? We'd better have a plan that's perfected and underway."