V_{SATP} = 24.8 L/mol

M_{O_2} = 32.00 g/mol

$$n_{O_2} = 1.9 \text{ kL} \times \frac{1 \text{ mol}}{24.8 \text{ L}}$$

$$n_{O_2} = 0.077 \text{ kmol}$$

$$m_{O_2} = 0.077 \text{ kmol} \times \frac{32.00 \text{ g}}{1 \text{ mol}}$$

$$m_{O_2} = 2.5 \text{ kg}$$

or

$$m_{O_2} = 1.9 \text{ kL} \times \frac{1 \text{ mol}}{24.8 \text{ L}} \times \frac{32.00 \text{ g}}{1 \text{ mol}}$$

$$m_{O_2} = 2.5 \text{ kg}$$

The mass of oxygen consumed would be 2.5 kg.

10.3 THE OZONE LAYER

PRACTICE

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Understanding Concepts

1. Ozone intercepts mostly the highest-energy (shorter wavelength) UV radiation from the Sun. Some UV radiation is absorbed by oxygen to become ozone, and some UV radiation is absorbed by ozone decomposing.
2. CFCs were developed as stable, non-toxic refrigerants, aerosol propellants, and foaming agents.
3. In the upper stratosphere, CFCs initiate reactions that increase the rate of decomposition of ozone.
4. An ozone "hole" is a (misleading) name for a region of very low ozone concentration; it is not a region where there is no ozone.
5. $$CF_3 + Br_{(g)} \xrightarrow{\text{uv}} CFBr_{2(g)} + Br_{(g)}$$
   $$Br_{(g)} + O_{3(g)} \rightarrow BrO_{(g)} + O_{2(g)}$$
   $$BrO_{(g)} + O_{(g)} \rightarrow Br_{(g)} + O_{2(g)}$$
6. Ozone depletion is less severe in the Arctic because it is not as cold as the Antarctic, and because there is more air mixing due to prevailing winds.
7. Suntanning time should be decreased proportionally to a drop in the level of ozone in the stratosphere. Current medical thinking is that there is no absolutely "safe" level of sunlight exposure; so the perceived benefits of outdoor activities — and particularly of deliberate tanning — must be weighed against the increased risks of skin damage and skin cancer.

SECTION 10.3 QUESTIONS

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Understanding Concepts

1. The Montreal Protocol is an agreement among nations to decrease the production and use of CFCs, to try to prevent damage to stratospheric ozone.
2. Freeon-12 is a CFC refrigerant that is routinely recycled.
3. HFE can replace CFCs for many uses, and hydrocarbons can be used as refrigerants.
4. Canada's Arctic Observatory and National Research Council contribute to research on effects of CFCs and the development of alternative substances.
5. Stratospheric ozone helps us by filtering potentially harmful UV radiation; but at low levels of the atmosphere (in the air we breathe) ozone is dangerous — a very reactive and toxic substance.