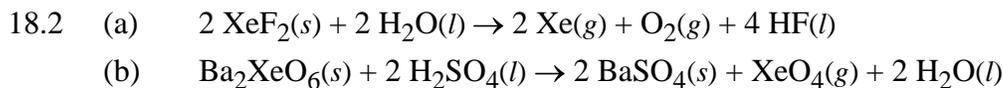


Chapter 18

THE GROUP 18 ELEMENTS: THE NOBLE GASES

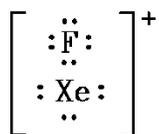
Exercises



18.4 Argon is more commonly used because it is readily available and comparatively inexpensive (because argon comprises 1 percent of the atmosphere). Xenon is a much rarer and more expensive gas (only 8.7×10^{-6} percent of the atmosphere).

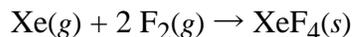
18.6 Noble gas compounds would be expected because compounds of neighboring elements are known with five, six, or seven electron pairs. Thus there is no conceptual reason why noble gas elements cannot covalently bond.

18.8 See the diagram. This ion would be isoelectronic with the iodine monofluoride molecule, IF, and so would be quite expected.

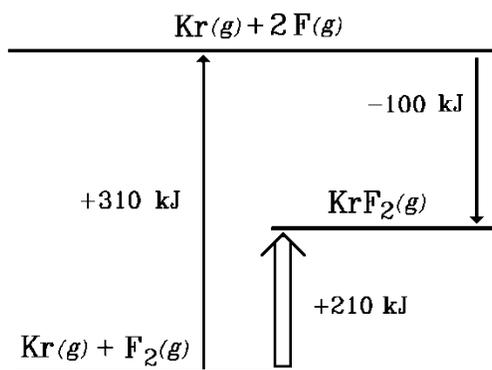


18.10 $\Delta G_f^\circ = \Delta H_f^\circ - T\Delta S_f^\circ$
 $\Delta S_f^\circ = [(-261.5 \text{ kJ}\cdot\text{mol}^{-1}) - (-121.3 \text{ kJ}\cdot\text{mol}^{-1})]/298 \text{ K}$
 $= -0.470 \text{ kJ}\cdot\text{mol}^{-1}\cdot\text{K}^{-1} = -470 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$

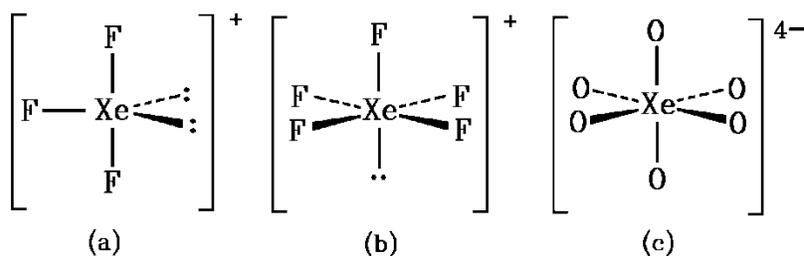
We would expect a significant decrease in entropy because the reaction involves the loss of three moles of gas per mole of compound formed.



18.12



18.14 The shapes of the ions are:



The Xe–O bonds can be depicted as single or double.

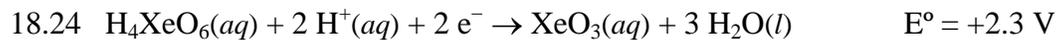
18.16 (a) Helium; (b) argon; (c) xenon.

18.18 Oxygen generally gives higher oxidation states to elements than fluorine, as oxygen can form multiple bond character involving filled $2p$ orbitals overlapping with empty d orbitals on the other element.

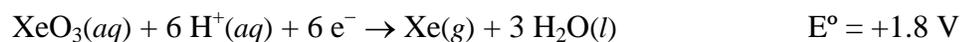
18.20 Radon is a particular hazard, not only because it is a radioactive gas but because its decay products are solids that can stick to the lung surface, continuing to radiate as the successive decays occur.

Beyond the Basics

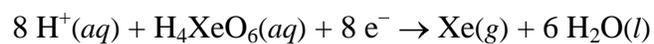
18.22 The Xe–Cl bond will be much weaker than the Xe–F bond, thus in the formation cycle, the enthalpy factor will be less favorable.



$$\Delta G^\circ = -2(\text{F})(+2.3 \text{ V}) = -4.6 \text{ F}$$



$$\Delta G^\circ = -6(\text{F})(+1.8 \text{ V}) = -10.8 \text{ F}$$



$$\Delta G^\circ = -15.4 \text{ F}, E^\circ = -\Delta G^\circ/n = +1.9 \text{ V}$$

