12.9: Group VIIIA- Noble Gases

The properties of the noble gases are summarized in the table below. The noble gases have a complete octet of electrons ns^2np^6 or just ns^2 for helium, leaving them with little chemical reactivity. Sure enough,the ionization energies of He and Ne are greater than 2000 kJ mol^{-1}, and it is unlikely that these noble gases will ever be induced to form chemical bonds. The same probably applies to Ar. Kr and especially Xe do form compounds though, which was discussed in the halogens section, and Rn might be expected to be even more reactive. Rn is radioactive, however, and study of its chemistry is difficult.

Table 12.9.1 Properties of the Group VIII Elements.

Element	Symbol	Electron Configuration	Usual Oxidation State	Radius/pm - Covalent
Helium	He	$1s^2$	0	...
Neon	Ne	$[He]2s^22p^6$	0	...
Argon	Ar	$[Ne]3s^23p^6$	0	...
Krypton	Kr	$[Ar]4s^23d^{10}4p^6$	+2	110
Xenon	Xe	$[Kr]5s^24d^{10}5p^6$	+8, +6, +4, +2	130

Symbol	Ionization Energy/MJ mol^{-1}		Density/ g cm^{-3}	Electro-negativity	Melting Point (in °C)
	First	Second			
He	2.379	5.257	0.179	...	-272
Ne	2.087	3.959	0.901	...	-249
Ar	1.527	2.672	1.78	...	-190
Kr	1.357	2.374	3.74	2.6	-157
Xe	1.177	2.053	5.86	2.4	-112

Because of the lack of reactivity of the noble gases, they are often used when an nonreactive atmosphere is needed, such as in welding. Due to their low boiling points, noble gases are also cryogens in their liquid forms. One familiar use of helium is in balloons and blimps, since it is buoyant in the atmosphere, and unlike hydrogen, nonreactive. Another familiar use is as lighting in gas discharge lamps. Referred to popularly as neon lights, they can contain other noble gases, or mixtures of the gases.