

Greenwood & Earnshaw

2nd Edition

Chapter 14

Oxygen

Oxygen

$^{16}_8\text{O}$ 99.763 % Oxygen makes up 45.5% of the earth's crust.
 $^{17}_8\text{O}$ 0.037% I = 5/2, poor sensitivity, 2.9% of ^1H , but oxygen very important
 $^{18}_8\text{O}$ 0.20 % nucleus so nmr is important.

Allotropes:

Dioxygen: O_2



Ozone: O_3



d = 120.74 pm
 $\Delta H_{\text{diss}} = 493.4 \text{ kJ/mol}$

d = 127.8 pm
 $Z = 117^\circ$

Oxygen comprises 23% of the atmosphere by weight, 46% of lithosphere, 85% of the hydrosphere. Dioxygen is paramagnetic, bp -183°C , slightly soluble in water, more soluble in organic solvents, very soluble in perfluorocarbon solvents (artificial blood). Highly reactive when catalysed or with ignition. $^3\Sigma_g^-$ ground state is activated by conversion to $^1\Delta_g$ excited state, $+94.74 \text{ kJ/mol}$.

Ozone, bp -111.9°C , mp -192.5°C , blue liquid, blue-black solid, $\Delta H_f = -142.7 \text{ kJ/mol}$, $\Delta G_f = -142.7 \text{ kJ/mol}$, very slowly decomposes (unless catalysed) to dioxygen, a serious tropospheric pollutant, but essential component in stratosphere where it absorbs solar ultraviolet radiation (220-290 nm), very reactive gas, pungent irritating odor.

Molecular Orbital Diagram - Dioxygen




















