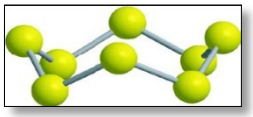
AS90933 Properties and uses of non-metals and selected compounds

	Carbon	Nitrogen	Oxygen	Sulfur	Chlorine
Allotropes and element stuff	**Buckminsterfullerene**, C_{60}, covalent molecular. **Diamond**, covalent network, very hard**,** no delocalised electrons. **Graphite**, covalent network, delocalised electrons within sheets, weak (but many) attractive forces between sheets. A good high-melting point conducting lubricant.	$N_2(g)$, molecular covalent. Strong covalent triple bond, very unreactive. :N≡N:	O_2 and O_3. Ozone layer at high altitude protects us from UV rays. It is toxic as highly oxidizing. Can be used to disinfect water with only oxygen as a by-product.	S_8 rings.  Monoclinic (needle-like) reverts to rhombic (plate-like). Plastic sulfur forms when liquid sulfur is cooled quickly.	$Cl_2(g)$, molecular covalent. Dense poisonous pale green gas. Turns damp blue litmus red then bleaches it. 
Ion	None.	N^{3-}, nitride	O^{2-}, oxide	S^{2-}, sulfide	Cl^-, chloride
Oxyanions	CO_3^{2-}, carbonate	NO_3^-, nitrate, NO_2^-, nitrite		SO_4^{2-}, sulfate, SO_3^{2-}, sulfite	OCl^-, hypochlorite
Industrial processes		Nitrogen is a raw material in the Haber Process which makes ammonia (see *compounds*). Catalyst, lumps of iron. High pressure and moderate temperatures needed. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$		Sulfur is a raw material in the Contact Process which makes sulfuric acid (see *compounds*). Catalyst, vanadium pentoxide makes $SO_3(g)$ which is dissolved in concentrated H_2SO_4 to make oleum, $H_2S_2O_7$.	
Compounds	CH_4, methane. CO_2, carbon dioxide, is a dense gas which doesn't support combustion. Turns limewater from clear to cloudy. Produced by reacting carbonates with acids or by respiration (aerobic and anaerobic).	NH_3, ammonia. Very soluble, basic gas. Turns damp red litmus blue.  Used to make nitric acid, some plastics and fertilisers, as well as being used as a refrigerant.	Metal oxides are generally basic. Non-metal oxides are acidic.	$SO_2(g)$, sulfur dioxide. Produced when sulfur burns with a pale blue flame. $S(s) + O_2(g) \rightarrow SO_2(g)$ Very soluble and strongly acidic. Used as a bleach and a preservative. H_2SO_4, sulfuric acid. Very widely used in many industrial processes *e.g.* drugs, explosives, detergents, dyes and pigments. Makes superphosphate (soluble) out of phosphate (insoluble).	Chlorine reacts with water producing HCl and HOCl. $Cl_2 + H_2O \rightarrow HCl + HOCl$ Hypochlorous acid, HOCl is a bleach and anti-bacterial compound. Household bleach is a solution of sodium hypochlorite.