BOND POLARITY

Electronegativity

Power of an atom to attract the two electrons in a covalent bond

								H 2.1									He
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne
Na 0.9	Mg 1.2											Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe
Cs 0.7	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.77	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.8	Bi 1.9	Po 2.0	At 2.2	Rn

factors that affect electronegativity	what it is
1 number of protons	• the negative electrons in the bonding pair are attracted to the positive nucleus • the more protons, the stronger the attraction
2 atomic radius	• the distance from the nucleus to the outer electrons • the closer the bonding pair to the nucleus, the stronger the attraction
3 shielding	• the repulsion of the bonding pair by electrons in inner shells between the nucleus and the bonding pair • the more shells between the bonding pair and the nucleus, the weaker the attraction

	trend in electronegativity	explanation
down a group	decreases	down the group: • atom gets bigger • more shielding • weaker attraction between the bonding pair and the nucleus
across a period	increases	across the period: • atom gets smaller • more protons • stronger attraction between the bonding pair and the nucleus

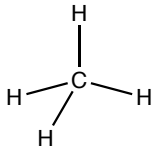
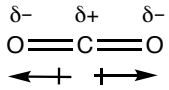
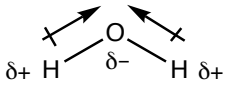
Polar covalent bonds

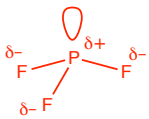
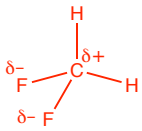
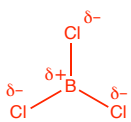
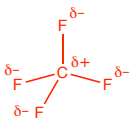
	non-polar covalent bond	polar covalent bond
when it happens	when the two atoms in a covalent bond have the same electronegativity	when the two atoms in a covalent bond have a different electronegativity
what it means	covalent bond where the two electrons are shared equally	covalent bond where the two electrons are not shared equally the more electronegative atom has a greater share of the two electrons and is δ– while the less electronegative atom has a lower share and is δ+
example	Cl–Cl bond in Cl_2	HCl bond in HCl $\overset{\delta+}{H}–\overset{\delta-}{Cl}$

Note

- Bonds that are polar have a **bond dipole moment** – this is a measure of the strength and direction of the polarity in the bond. In simple terms, the bigger the difference in electronegativity, the bigger the bond dipole moment.
- C-H bonds in organic molecules are not regarded as being polar (although there is a small difference in electronegativity between the C and H)

Polar molecules

	non-polar molecule		polar molecule
description	no polar bonds	contains polar bonds but all the dipole moments cancel out	contains polar bonds but all the dipole moments do not cancel out
example	CH_4 	CO_2 	H_2O 
intermolecular forces	van der Waals' only	van der Waals' only	van der Waals' **and** dipole-dipole or H-bonds (depending on molecule)

Molecule	Sketch of shape	Does it contain polar bonds?	Is the molecule polar?	Intermolecular forces		
				van der Waals' (✓)	dipole-dipole (✓)	hydrogen bonds (✓)
PF_3		✓	✓	✓	✓	✗
CH_2F_2		✓	✓	✓	✓	✗
Br_2		✗	✗	✓	✗	✗
BCl_3		✓	✗	✓	✗	✗
CF_4		✓	✗	✓	✗	✗
HCl		✓	✓	✓	✓	✗