Atoms (elements)

The smallest particles of ordinary matter.

- Atomic symbol = a one or two letter abbreviation for each of the types of atoms

Table 2.1

Atom	Symbol
Carbon	C
Hydrogen	H
Oxygen	O
Nitrogen	N
Calcium	Ca
Phosphorus	P
Sodium	Na
Potassium	K
Chlorine	Cl
Sulfur	S
Iron	Fe
Magnesium	Mg

Table 2.1

Molecule (compound)

Two or more atoms joined together

• Bond = The force that joins one atom to another

√ Bonds are usually shown as a line linking the atoms

√ Example molecules:

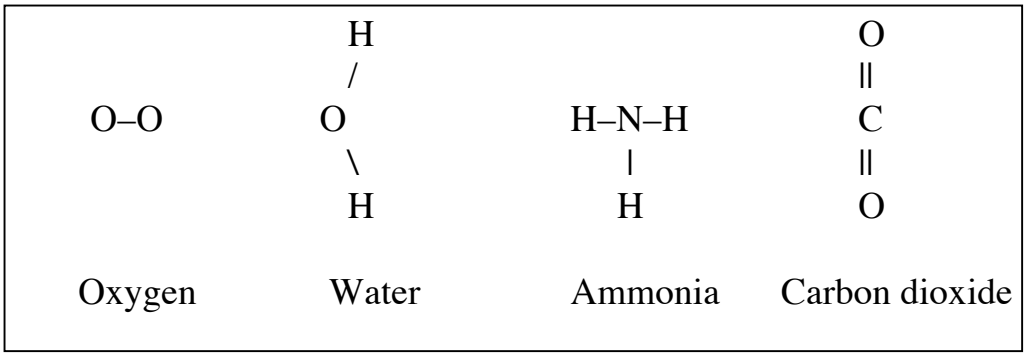

Fig 2.11

Molecular formula

A way to write a molecule

• All the atomic symbols of the atoms in the molecule are written together, with small numbers to show how many of each atom there are:

Example: H_2O = a molecule of water. It is made of two hydrogen atoms and one oxygen atom

• A large number in front of the molecular formula shows how many molecules are present:

Example: $3H_2O$ = Three water molecules

Fig 2.11

Subatomic particles

The particles that atoms are made out of

- Protons, neutrons, and electrons.

Particle:	Location:	Electric charge:
Proton (p^+)	Nucleus	+1
Neutron (n)	Nucleus	0
Electron (e^-)	Orbital	-1

Fig 2.4

Atoms start out with equal numbers of electrons and protons, so their overall electrical charge adds up to zero.

- Atoms can gain or lose electrons

Ion

An electrically charged atom or molecule

- Atoms become ions by gaining or losing electrons
  - √ Charge = -1 for every electron gained
  - √ Charge = +1 for every electron lost
- The electric charge is shown in the upper right
- Examples:

Na^+	Cl^-
Mg^{2+}	Ca^{2+}
H^+	K^+
OH^- (hydroxide ion)	
PO_4^{3-} (phosphate ion)	
HCO_3^- (bicarbonate ion)	

Fig 2.13

Electrostatic attraction

The attraction between opposite electrical charges

Ionic bond

A bond formed by the electrostatic attraction between a positive ion and a negative ion

- Water can break most ionic bonds (separate the ions)

Fig 2.13

Covalent bond

A bond formed when two atoms share a pair of electrons

- Each atom contributes one electron to the shared pair

- Covalent bonds are shown as a dash between the atoms

Figs 2.10 and 2.11

Polar covalent bond

A covalent bond where one atom pulls more strongly on the electron pair than the other atom

• Oxygen and Nitrogen are strong electrons pullers

√ They become partially negative (shown as δ^-) because the electron pair moves closer to them

√ The other atom in the polar bond becomes partially positive (shown as δ^+) because the electron pair moves away from it

• Four common polar covalent bonds:

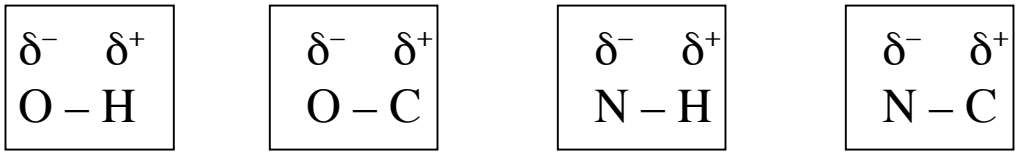

Fig 2.12

Non-polar covalent bond

A covalent bond where the electron pair is shared evenly

• Non-polar covalent bonds have no partial charges

• Examples: C – H C – C

§ Be able to assign proper partial charges to the atoms in a molecule

Temperature

The kinetic energy (movement energy) of a substance's molecules

• The higher the temperature, the faster the molecules are moving

Chemical reaction

When molecules are changed (their atoms are rearranged into new molecules)

• Chemical reactions are written in this way:

a) All the reactants (old molecules) are written on the left

b) An arrow is written in the middle

c) All the products (new molecules) are written on the right.