

UNIT 1 SUMMARY SHEET BUILDING BLOCKS

- There are about 100 elements from which everything is made. Each element is given a unique name and symbol.
- Elements are arranged in the periodic table.
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A horizontal row is called a **period**. As you go across a period, the elements change from reactive metals on the left to unreactive non-metals on the right. On the extreme right are the noble gases.

A vertical column is called a **group**. Elements in the same group have similar properties. As you go down a group, the properties change gradually.

The numbered position of the element is its **atomic number**. The higher the atomic number, the bigger the atom.

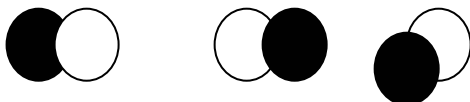
Some groups have special names:

- Group 1 The alkali metals
- Group 2 The alkaline earth metals
- Group 7 The halogens
- Group 0 The noble gases

- Elements that are in the same group have similar properties

Group	Property
Noble gases	Unreactive gases
Halogens	Very reactive non-metals
Alkali metals	Very reactive metals

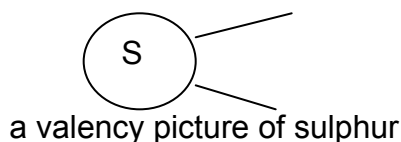
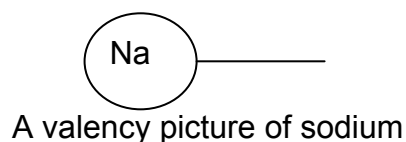
- Elements can be grouped in different ways e.g. Metals/non-metals, solids, liquids, gases.
- Compounds are formed by different elements chemically bonding in a reaction



- All chemical reactions result in one or more new substances being formed.
- Compounds which end in - IDE contain only two elements
- There are some exceptions to the IDE rule e.g. hydroxide , cyanide
- Compounds which end in ITE or ATE contain more than two elements one of which is oxygen.
- The valency of an element is the number of bonds an element can have.
- The valency of an element can be calculated using the periodic table:

Groups 1 to 4 valency = group number
Groups 4 to 8 valency = 8 - group number

e.g. Sodium is in group 1 hence valency 1. Sulphur is in group 6 hence valency = 2

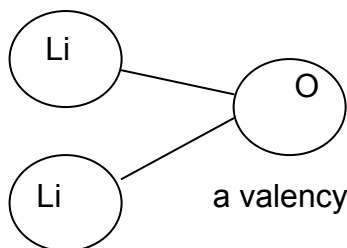


13. The formulae of 2 element compounds can be worked out using the periodic table.

e.g. lithium oxide

Lithium is in group 1 hence valency 1

Oxygen is in group 6 hence valency 2



Formula Li_2O

14. Compounds with mono(1), di(2), tri(3) or tetra(4) in their name are written as they sound

e.g. Carbon monoxide

Carbon with one oxygen

Formula CO

15. Some elements can have more than one valency. In these elements the valency is indicated by using roman numerals in the name.

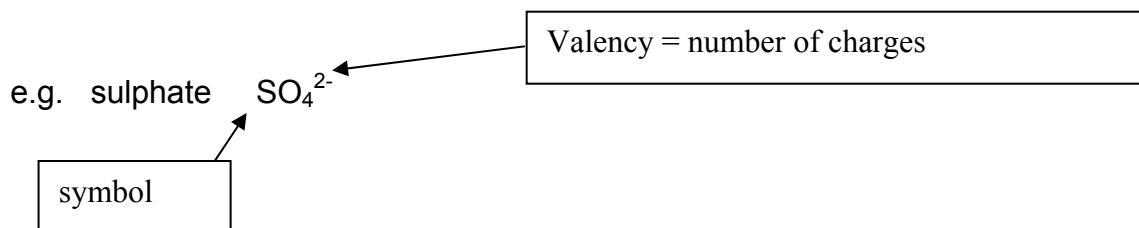
e.g. Iron(III) oxide

Iron roman numeral 3 hence valency 3

Oxygen group 6 hence valency 2

Formula Fe_2O_3

16. Compounds which end in ITE or ATE contain groups whose formula and valency can be calculated using the table of selected ions found in the data book



e.g. sodium sulphate

Sodium group 1 hence valency = 1

Sulphate 2 charges hence valency = 2

Formula Na_2SO_4

17. When a formula contains more than one group then brackets are used

e.g. Calcium nitrate

Calcium valency = 2

Nitrate valency = 1

Formula $\text{Ca}(\text{NO}_3)_2$

18. Chemical reactions can be written as equations.

Word Equation

Calcium carbonate + hydrochloric acid \longrightarrow calcium chloride + water + carbon dioxide

REACTANTS

PRODUCTS

Symbol Equation

$\text{CaCO}_3 + \text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$

19. Chemical reactions can be identified by; changes in appearance, colour changes, gas evolved, or precipitate formed. Chemical reactions can also be identified by energy changes.

20. An exothermic reaction is one in which energy is released to the surroundings e.g. there is a temperature rise when iron corrodes.

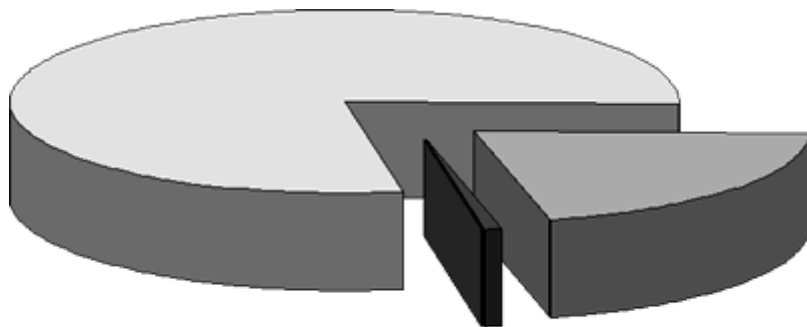
21. In exothermic reactions the energy of the products are less than the energy of the reactants.

22. In endothermic reactions energy is taken in from the surroundings e.g. there is a temperature drop when barium hydroxide reacts with ammonium nitrate.

23. In endothermic reactions the energy of the products is higher than the energy of the reactants.

24. Mixtures occur when two or more substance come together without reacting
Air is an example of a mixture.

Composition of Air



■ Nitrogen ■ Oxygen ■ Argon ■ Carbon Dioxide

Component	Symbol	Volume	
Nitrogen	N ₂	78.084%	99.998%
Oxygen	O ₂	20.947%	
Argon	Ar	0.934%	
Carbon Dioxide	CO ₂	0.033%	
Neon	Ne	18.2 parts per million	
Helium	He	5.2 parts per million	
Krypton	Kr		

25. A test for oxygen is that it relights a glowing splint (normally there is not enough oxygen in the air to give a positive test).

26. A test for carbon dioxide is that it turns limewater from clear to milky white.

27. A solution is formed when a substance dissolves in a liquid.

28. SOLUTE + SOLVENT \longrightarrow SOLUTION
(substance (liquid dissolved))

29. A substance which dissolves is soluble. A substance that does not dissolve is insoluble.

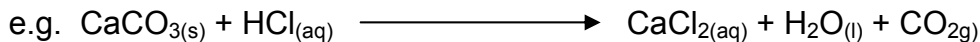
30. Solutions have a wide variety of uses.

Substance	Use	Reason
Carbon dioxide	Drinks, water	Gives drinks fizz
Chlorine	Water supplies	Kills bacteria
Sodium fluoride	Water supplies	Prevents tooth decay

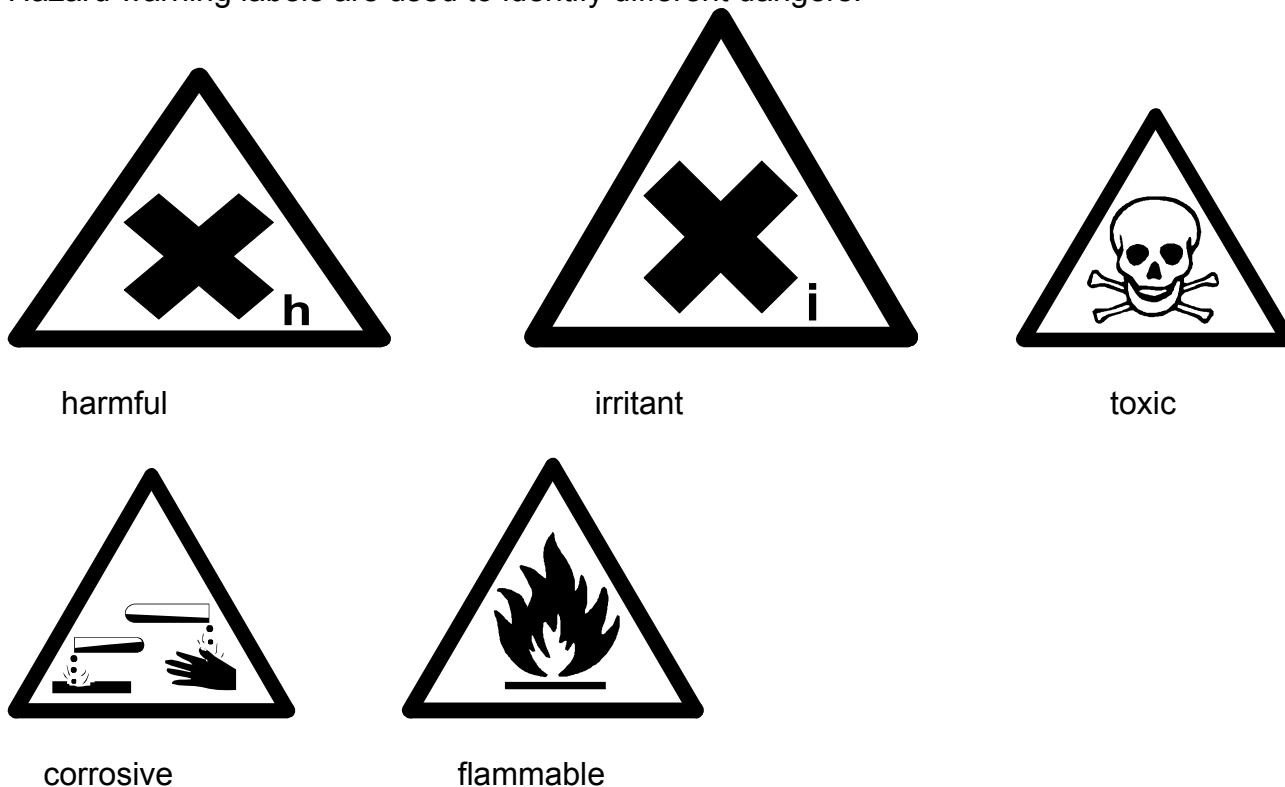
31. Some substances that dissolve in our water supply are harmful e.g. lead compounds caused by water travelling through lead pipes can cause brain damage.

32. In equations we represent the state of a substance by using state symbols.

State	symbol
Solid	s
Liquid	l
Gas	g
Solution	aq



33. Regulations on the use of chemicals exist for the safety of everyone who uses them. Hazard warning labels are used to identify different dangers.



34. Road tankers carry hazard symbols to indicate dangers in the event of spillage

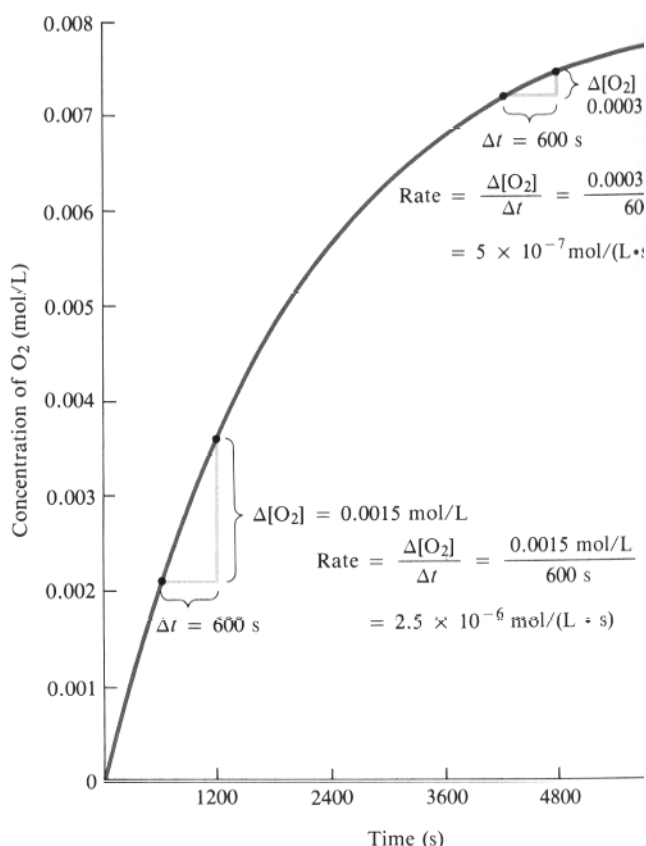
35. The rate of a reaction is affected by changes in concentration , particle size and temperature.

change	rate	Collision theory
concentration	more concentrated faster reaction	Particles closer together hence more collisions
surface area	larger surface area(powder) faster rate of reaction	More particles in contact hence more collisions
temperature	higher temperature faster reaction	Do not need to know

36. Rates of reaction can be measured by following the change in concentration, mass and volume of reactants or products with time.

37. The rate of a reaction at any time during a reaction can be calculated using the formula

$$\text{Rate} = (\text{Change in reactant/product}) / \text{change in time}$$

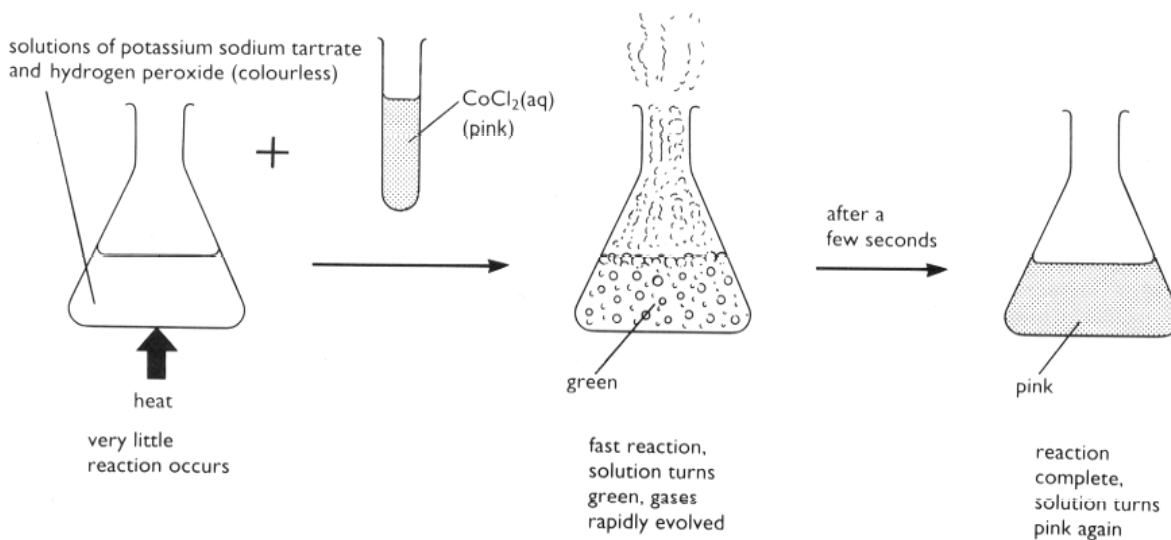


38. A reaction slows down with time as the concentration of reactants fall.

39. The rate of a reaction is proportional to 1/time i.e. the longer the time for the reaction the slower the reaction.

40. Catalysts are substances that speed up reactions but are not used up in the reaction.

41. A homogeneous catalyst is a catalyst that is in the same state as the reactants.



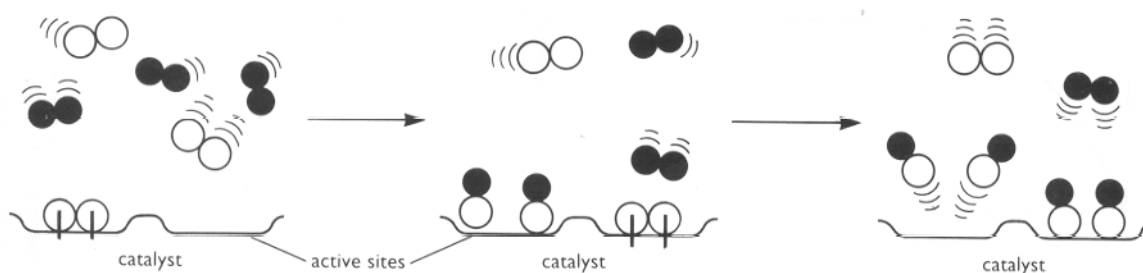
42. A heterogeneous catalyst is a catalyst which is in a different state from the reactants e.g. Manganese dioxide powder speeds up the rate at which hydrogen peroxide decomposes.

43. Catalysts are used in many industrial processes

Catalyst	Process	Reaction	Importance
Vanadium oxide	Contact	$\text{SO}_2 + \text{O}_2 \rightarrow \text{SO}_3$	Making sulphuric acid
Platinum	Ostwald	$\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2\text{O}$	Making nitric acid
Iron	Haber	$\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$	Making ammonia
Aluminium silicate	Cracking	Breaking down long chained hydrocarbons	Making fuels and plastics
Nickel	Hydrogenation	Unsaturated oils to saturated fats	Making margarine

44. Impurities in the reactants result in industrial catalysts needing to be regenerated or renewed.

45. Heterogeneous catalyst work by adsorption of reactant molecules.



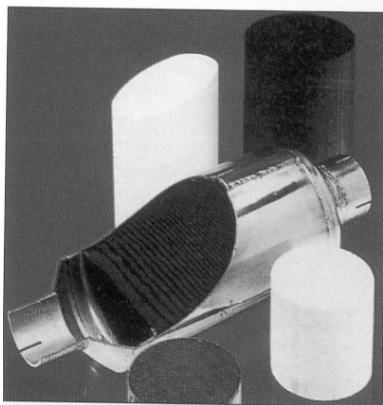
(a) *Adsorption*
Molecules of one or both reactants form bonds with the catalyst. This weakens the bonds within the molecules.

(b) *Reaction*
The molecules react on the catalyst surface. The angle of collision is more likely to be favourable since one of the molecules is fixed.

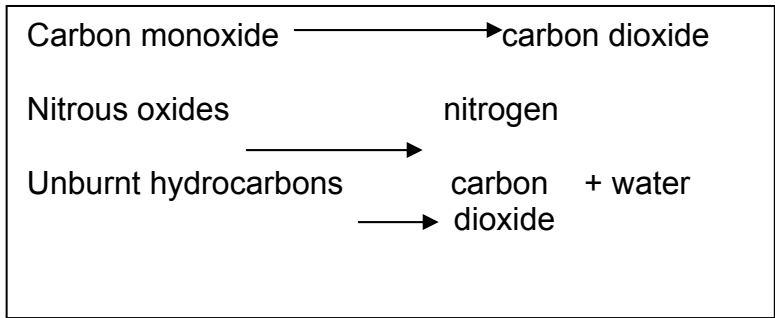
(c) *Desorption*
The product molecules leave the catalyst and the vacant site can be occupied by another reactant molecule.

46. Some substances can bond with the catalyst and prevent it working properly. This is called catalytic poisoning. These substances bond to the “active site” of the catalyst preventing the reactant being adsorbed.

47. Catalytic converters in cars reduce pollution.



a catalytic converter

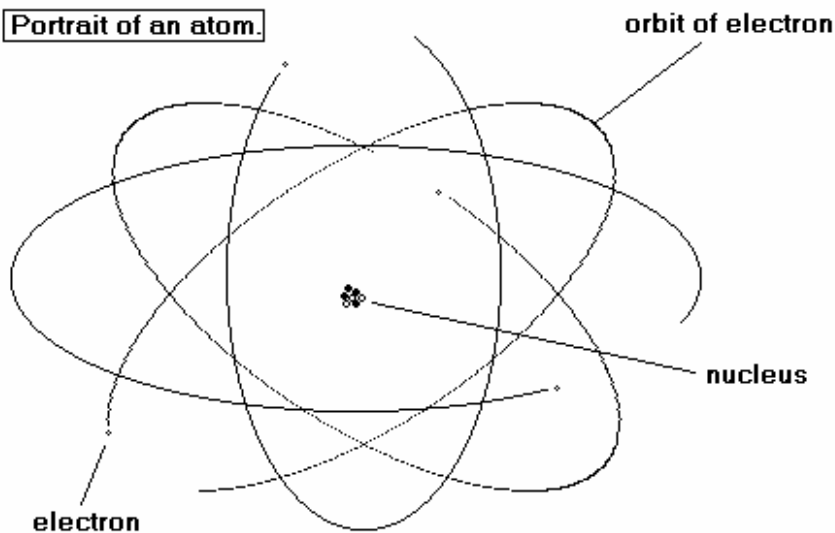


48. Enzymes are biological catalysts found in both plant and animal cells

49. Enzymes are used both in industry and in the home.

Enzyme Uses
Biological washing powders
Producing syrups
Paper industry
Cheese making

50. Every substance is made up of small particles called atoms.



The nucleus of the atom is composed of neutrons and protons.

50.

particle	charge	mass	location
Proton	+1	1 AMU	Nucleus
Neutron	0	1 AMU	Nucleus
Electron	-1	Practically zero	Electron cloud

