

All you need to know about ...

Module C5

OCR 21st Century Science

ATMOSPHERE (AIR)

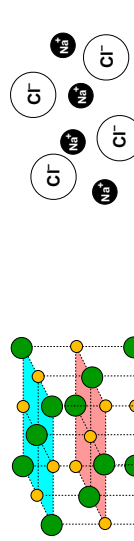
- dry air consists of elements (O₂, N₂, Ar) and compounds (CO₂)
- elements / compounds in the air are gases because they consist of small molecules with weak forces of attraction between them
- atoms in molecular substances are joined by covalent bonds



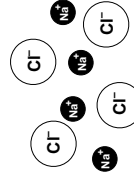
- some molecular compounds have low melting and boiling points
- #### COVALENT BONDING
- pure molecular compounds do not conduct electricity because their molecules are not charged
 - atoms in molecular substances are joined by covalent bonds
 - covalent bonding arises from the electrostatic attraction between the nuclei of the atoms and the electrons shared between them
 - covalent bonds are strong so atoms are held strongly
 - attractions between molecules are weak; easy to separate them

IONIC BONDING

- in solid ionic compounds the ions are arranged in a regular way
- ions are held together by the attraction between opposite charges
- the physical properties of solid ionic compounds are due to their giant, three-dimensional structures

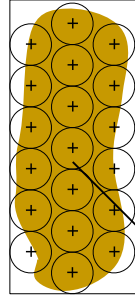


sodium chloride in water or when melted



METALLIC BONDING

- metals are made from a **giant structure** of atoms held together by strong metallic bonding
- positive ions are held together by a **sea of electrons that are free to move about**

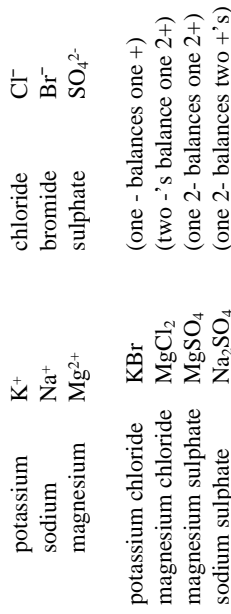


sea of electrons

HYDROSPHERE (OCEANS)

- consists mainly of water with some dissolved compounds
- sea water is salty - contains dissolved ionic compounds (salts)

You can calculate the formulae of salts by balancing the positive and negative charges on ions

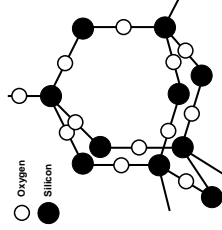


BIOSPHERE (LIVING THINGS)

- living things are mainly made up from compounds containing the elements C, H, N and O with small amounts of P and S
- carbohydrates, proteins and DNA are molecules
- carbohydrates contain C, H and O only eg C₆H₁₂O₆
- proteins contain C, H, N and O and sometimes S and P
- DNA contains C, H, N and O and sometimes S and P
- fats contain C, H and O
- chemicals can move between the spheres as part of cycles

LITHOSPHERE (CRUST + PART OF MANTLE)

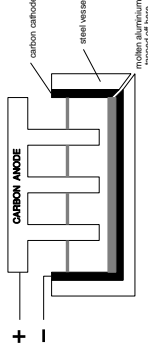
- the rigid outer layer of Earth is a mixture of minerals
- silicon, oxygen and aluminium are very abundant elements
- much of the silicon and oxygen is in silicon dioxide
- silicon dioxide is hard, has a high melting point, is insoluble in water and doesn't conduct electricity
- silicon dioxide is a **giant structure**
- diamond has a similar giant structure
- atoms are held together by **strong covalent bonds**
- a lot of energy is needed to break bonds and separate the atoms
- have high melting points
- silicon dioxide is found as quartz in granite and in sandstone
- some minerals make valuable gemstones because of their rarity, hardness and appearance



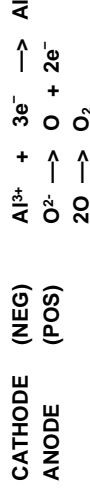
○ oxygen
● silicon

EXTRACTION OF METALS

- ores are rocks that contain varying amounts of minerals from which metals can be extracted
- for some minerals, large amounts of ore need to be mined to recover small percentages of valuable minerals (Cu)
- Zn, Fe and Cu are extracted by heating the oxide with carbon
- ZnO + C → CO + Zn
- when a metal oxide **loses oxygen** it is **reduced**
- when carbon **gains oxygen** and is **oxidised**
- oxides of very reactive metals cannot be reduced by carbon
- the **state symbols** are (s), (l), (g) and (aq)
- electrolysis** = decomposition of electrolytes with electricity
- electrolytes** conduct electricity but decompose
- electrolytes include molten ionic compounds
- when an ionic crystal melts the ions are free to move apart
- during electrolysis, metals form at the negative electrode
- during electrolysis, non-metals form at the positive electrode
- Al is extracted from molten aluminium oxide by electrolysis



- during electrolysis of molten Al₂O₃, positively charged aluminium ions gain electrons from the negative electrode to become neutral atoms



- negative oxide ions lose electrons to the +ive electrode to become neutral atoms which combine to form O₂ molecules
- the properties of metals (**strength, malleability, melting point and electrical conductivity**) affect how they are used
- extraction, use and disposal of metals affect the environment

MINING - LANDFILL - ENERGY COSTS

CALCULATIONS

- relative formula mass = sum of relative atomic masses
e.g. **Fe₂O₃ = 56 + 56 + 16 + 16 + 16 = 160**
- mass of iron present in Fe₂O₃ = **56 + 56 = 112**
- percentage of iron present in Fe₂O₃ = **112 x 100 = 70%**
160