Edexcel GCSE Chemistry

Topic 5: Separate chemistry 1

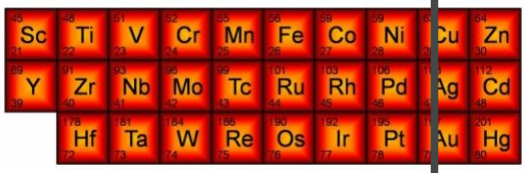
Transition metals, alloys and corrosion

Notes

5.1C Recall that most metals are transition metals and that their typical properties include: high melting point, high density, the formation of coloured compounds, catalytic activity of the metals and their compounds as exemplified by iron

properties of transition metals:

- High melting point (due to electrostatic forces of attraction between positively charged metal ions and 'sea' of electrons)
- High density
- They have ions with many different charges
- Form coloured compounds
- Are useful as catalysts.
    - Shown by iron and its use in the Haber process as a catalyst



5.2C Recall that the oxidation of metals results in corrosion

- Corrosion = destruction of materials by chemical reactions with substances in the environment
    - E.g. rusting
        - Both air and water are necessary for iron to rust – i.e. oxidation – gain of oxygen results in corrosion

5.3C Explain how rusting of iron can be prevented by: exclusion of oxygen, exclusion of water, and sacrificial protection

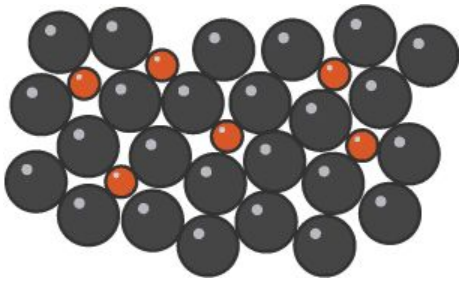
- rusting can be prevented by excluding oxygen and water e.g. by:
    - painting
    - coating with plastic
    - using oil or grease
- Aluminium has an oxide coating that protects the metal from further corrosion – exclusion of oxygen and water
- water can be kept away using a desiccant in the container (absorbs water vapour)
- oxygen can be kept away by storing the metal in a vacuum container
- Sacrificial protection: where the metal you want to be protected from rusting is galvanised with a more reactive metal, which will rust first and prevent water and oxygen reaching the layer underneath
    - E.g. zinc is used to galvanise iron

5.4C Explain how electroplating can be used to improve the appearance and/or the resistance to corrosion of metal objects

- Electroplating acts as a barrier in order to exclude oxygen and water
- Also improves appearance as you can electroplate a metal with an unreactive metal such as gold that is more attractive and will not corrode
- it is done using the metal to be plated as the cathode and the metal you're plating it with as the anode, then have a solution containing ions of the metal being used to do the plating

5.5C Explain, using models, why converting pure metals into alloys often increases the strength of the product

- Most metals in everyday uses are alloys.
- Pure copper, gold, iron and aluminium are all too soft for everyday uses and so are mixed with small amounts of similar metals to make them harder for everyday use.
- this works because in a pure metal, all the + metal ions are the same size and in a regular arrangement, allowing the layers to slide over each other relatively easily, making the metal soft and malleable. In an alloy, you have + ions of different metals, which have different sized ions. This disrupts the regular structure and prevents the ions being able to slide as easily, leaving a much harder, stronger metal.



Example of an alloy – two different metals

5.6C Explain why iron is alloyed with other metals to produce alloy steels

Steels are alloys since they used mixtures of carbon and iron

- o Some steels contain other metals. Alloys can be designed to specific uses.
- o Low-carbon steels are easily shaped - used for sheeting (malleable)
- o High carbon steels are hard - used for cutting tools
- o Stainless steels (containing chromium and nickel) are resistant to corrosion - used for cutlery

5.7C Explain how the uses of metals are related to their properties (and vice versa), including aluminium, copper and gold and their alloys including magnalium and brass

- aluminium: low density, used for aircraft
- copper: good conductor, used in electrical cables
- gold: good resistance to corrosion, used in jewelry
- magnalium (aluminum + magnesium): low density, used in cars and planes
- brass (copper + zinc): hard, resistant to corrosion, used in coins