OCR B GCSE Chemistry

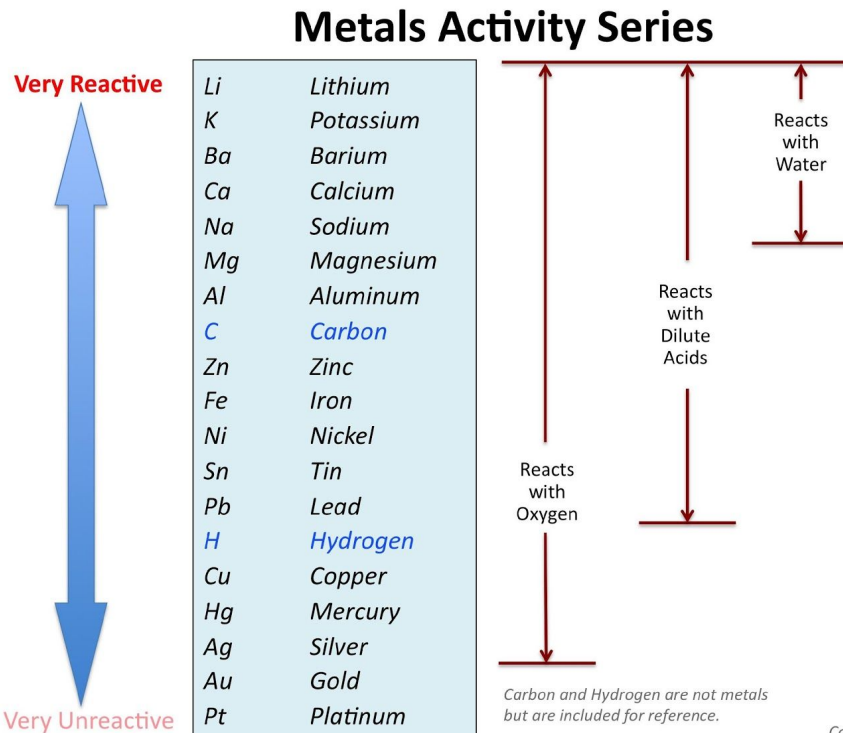
Topic 3: Chemicals of the natural environment

How are metals with different reactivities extracted?

Notes

1. Deduce an order of reactivity of metals based on experimental results including reactions with water, dilute acid and displacement reactions with other metals

- When metals react with other substances, metal atoms form positive ions
- Reactivity of a metal is related to its tendency to form positive ions
- Metals can be arranged in order of their reactivity in a reactivity series
    - Metals potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper can be put in order of their reactivity from their reactions with water and dilute acids
    - Non-metals hydrogen and carbon are often included in the reactivity series
- A more reactive metal can displace a less reactive metals from a compound (think about how this is similar as well to halogens)



- acid + metal → salt + hydrogen (gas therefore bubbles)
    - More bubbles = more reactive metal
- metal + water → metal hydroxide + hydrogen

2. Explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion to include potassium, sodium, calcium, aluminium, magnesium, zinc, iron, lead, [hydrogen], copper, silver

- Metals react by forming positive ions therefore a metal that tends to form a positive ion more than another is more reactive
    - Greater tendency to form a positive ion = more reactive metal
- Metal + dilute acid → salt + hydrogen
- Metal + water → metal hydroxide + hydrogen

3. Use the names and symbols of common elements and compounds and the principle of conservation of mass to write formulae and balanced chemical equations (HT only) and ionic equations

chemical formulae:

- For simple ionic – just balance the charges of the ions involved
- For simple covalent – imagine what the ion would be, e.g. H_2O balances – because the ions would be $2H^+$ and O^{2-} (and ++ cancels out with 2x -)

conservation of mass:

- Law of conservation of mass: no atoms are lost or made during a chemical reaction so the mass of the products = mass of the reactants
- Therefore, chemical reactions can be represented by symbol equations, which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation.
- Use this law to write chemical equations

ionic equations (HT only):

- Write out the full chemical equation
- Split (aq) substances up into ions e.g. HCl(aq) becomes $H^+(aq) + Cl^-(aq)$ and write out as a separate equation
- Cancel out 'spectator ions' – unchanged ions on either side of the chemical equation
- You are now left with the ionic equation

4. Explain, using the position of carbon in the reactivity series, the principles of industrial processes used to extract metals, including the extraction of zinc

- The second to last element is gold, since it is very unreactive, it is found in the Earth as the metal itself
- But, most metals are found as compounds that require chemical reactions to extract the metal
- Metals less reactive than carbon
    - Can be extracted from their oxides by reduction with carbon
        - Don't forget: reduction involves the loss of oxygen
- e.g. Zinc is extracted by reaction with carbon since it is less reactive than carbon

5. Explain why electrolysis is used to extract some metals from their ores

- electrolysis is used when an element is more reactive than carbon, so can't be extracted in this way
- electrolysis requires large amounts of electrical energy so wouldn't generally be used if the metal could be extracted using carbon

6. (HT only) evaluate alternative biological methods of metal extraction (bacterial and phytoextraction)

- Phytoextraction
    - Some plants absorb metal compounds through their roots
    - They concentrate these compounds as a result of this
    - The plants can be burned to produce an ash that contains the metal compounds
- Bacterial extraction
    - Some bacteria absorb metal compounds
    - Produce solutions called leachates which contain the metals