Edexcel IGCSE Flashcards

Section 2: Inorganic Chemistry

State three characteristics of the Alkali Metals

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All have one electron in their outer shell; have low density; are stored under oil (to prevent reactions with oxygen or water); are soft (can be cut with knife).

How do Group 1 elements react with non-metals? Why are these reactions similar for the different Group 1 elements?

How do Group 1 elements react with non-metals? Why are these reactions similar for the different Group 1 elements?

They form ionic compounds which are soluble white solids which form colourless solutions – they all have one electron in their outer shell.

How do Group 1 elements react with water?

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They release hydrogen gas and form hydroxides which dissolve to form alkaline solutions; react vigorously with water fizzing and moving around on the surface of the water.

How does the reactivity change moving down Group 1? Why?

How does reactivity change moving down Group 1? Why?

It increases as the atoms get larger and the distance between the nucleus and the outer electrons increases and thus attraction from the nucleus decreases, allowing them to more easily lose electrons.

State five characteristics of Group 7

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- 7 electrons in outer shell
- Coloured vapours
- Diatomic molecules
- Form ionic salts with metals
- Form molecular compounds with non-metals

State Group 7 elements and their states of matter.

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- Fluorine, F. F_2 is a pale yellow gas.
- Chlorine, Cl. Cl_2 is a pale green gas.
- Bromine, Br. Br_2 is dark brown liquid (gives off orange vapour at room temperature).
- Iodine, I. I_2 is a grey solid (gives off purple vapour when heated).
- Astatine, At. At_2 solid at room temperature.

State three changes that occur in Group 7 as one moves down the group

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- Higher relative molecular mass
- Higher melting and boiling point
- Less reactive – electrons less easily gained

A more reactive halogen displaces a less reactive one from an aqueous solution of its salt; write the equations and state the colour change seen when chlorine reacts with sodium bromide and when chlorine/bromine reacts with sodium iodide.

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$Cl_2 + 2\ NaBr \rightarrow Br_2 + 2\ NaCl$, or
$Cl_2 + 2Br^- \rightarrow Br_2 + 2\ Cl^-$;
in this reaction, an orange colour of Br_2 would appear

$Cl_2 + 2\ NaI \rightarrow I_2 + 2\ NaCl$, or $Cl_2 + 2I^- \rightarrow I_2 + 2\ Cl^-$
$Br_2 + 2\ NaI \rightarrow I_2 + 2\ NaBr$, or $Br_2 + 2I^- \rightarrow I_2 + 2\ Br^-$;
in these two reactions, a brown colour of I_2 would appear

A more reactive halogen displaces a less reactive one from an aqueous solution of its salt; explain the trend in reactivity of halogens in these reactions

A more reactive halogen displaces a less reactive one from an aqueous solution of its salt; explain the trend in reactivity of halogens in these reactions

Reactivity decreases down the group. As we go down the group, the atoms get larger, so an incoming electron will be less tightly held by the attractive forces from the nucleus. That's why Cl_2 displaces Br^- and I^-.

Compare Group 1 metals and transition metals

Compare group 1 metals with transition metals

Group 1 metals and transition metals are heat and electricity conductors. They are shiny when polished and form ionic compounds with non metals.

Transition metals have higher densities and higher melting points than Group 1 metals. They are less reactive and harder than Group 1 metals.

State three common characteristics of transition metals

State three common characteristics of transition metals

- Form ions with different charges
- Coloured compounds
- Catalytic properties

What are the “rules” for solubility of salts?

What are the “rules” for solubility of salts?

K^+, Na^+,NH_4^+ - all salts soluble

NO_3^- - all salts soluble

SO_4^{2-} - all soluble, except Pb^{2+}, Ba^{2+}, Ca^{2+}

Cl^- - all soluble, except Pb^{2+}, Ag^+

CO_3^{2-} - all INsoluble, except K^+, Na^+,NH_4^+

What is rusting?

What is rusting?

It is a process of forming hydrated iron (III) oxide.

When iron is exposed to water and air, it forms hydrates of Fe_2O_3.

This leaves a brown deposit on the surface of a material.

Outline how you would prepare a sample of $PbSO_4$

Outline how you would prepare a sample of $PbSO_4$

Mix a solution of a soluble Pb (II) salt, e.g. nitrate, with a source of sulfates, e.g. Na_2SO_4

$PbSO_4$ is insoluble in water - precipitate forms. Filter to collect the precipitate. Wash with H_2O.

Leave to dry.

Outline how you would prepare a sample of NaCl from NaOH and HCl

Outline how you would prepare a sample of NaCl from NaOH and HCl

In this case, we don't know when to stop adding one of the reagents - there is no indication of the completion of our reaction.

You can use an indicator in this case, just like in acid/base titration. Adding one of the reagents by a burette will help with accuracy.

Then boil the mixture to remove some solvent and leave to crystallise. Filter and dry the product.

You have a sample of a pure liquid. How could you check its identity?

You have a sample of a pure liquid. How could you check its identity?

Measure the boiling point.

Say we have water - it boils at 100 Celsius degrees.

How can you show that a liquid contains pure water?

How can you show that a liquid contains pure water?

Add the liquid being tested to a sample of pure, anhydrous crystals of $CuSO_4$ (white).

The positive test will result in the formation of the blue, hydrated copper (II) sulfate.

What is an oxidising agent?
What is a reducing agent?

What is an oxidising agent? What is a reducing agent?

An oxidising agent is a species that gets reduced in a redox reaction (gains electrons; causes the oxidation of another substance).

A reducing agent is a species that gets oxidised in a redox reaction (loses electrons; causes the reduction of another substance).

How could you test for the presence of NH_4^+ ions?

How could you test for the presence of NH_4^+ ions?

Add some NaOH to the aqueous solution of the tested salt.

Shake gently. Put a damp litmus paper near the outlet of the test tube.

The damp litmus paper will turn blue if NH_4^+ were present in your solution (NH_3 formation)

State the colours of flames observed when lithium, sodium, and potassium burn in oxygen

State the colours of flames observed when lithium, sodium, and potassium burn in oxygen

Crimson-red, Li
Yellow-orange, Na
Lilac, K

How to conduct a titration?

How to conduct a titration?

a) Rinse the pipette with a solution of unknown concentration. Use the pipette to measure out the known volume of this solution.
b) Add an indicator (a substance that changes colour at the end of titration)
c) Rinse the burette with a solution of known concentration. Discard the liquid. Use a burette to gradually add the solution of a known concentration.
d) When indicator changes colour (at the end point), the volume added is recorded.
e) It is important to get concordant volume results - they have to lie close to each other.
f) Suitable calculations are performed to find the concentration.

What is oxidation/reduction?

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Oxidation is the addition of oxygen to a substance.

Reduction is the loss of oxygen from a substance.

What is the reactivity series of metals? What are the trends in reactivities of metals in reactions with acids/water?

What is the reactivity series of metals? What are the trends in reactivities of metals in reactions with acids/water?

The series shows the metals in order of their reactivity.

Metals above H_2 in reactivity series react with acid to produce H_2. The more reactive the metal is, the quicker and more violent reaction with acid occurs.

Metals below H_2 don't react with acids.

Not all metals above H_2 react with water - mostly Group I and II metals. Aluminium is the borderline case.

What is a displacement reaction?

What is a displacement reaction?

A reaction where a more reactive metal displaces a less reactive metal in a compound.

How are unreactive metals found in Earth?

How are unreactive metals found in Earth?

In their natural state, that being the metal alone rather than in a compound (well, they are unreactive…).

How can metals less reactive than carbon be extracted?

How can metals less reactive than carbon be extracted?

Reduction with carbon. Carbon displaces the metal in a metal oxide - gets oxidised to carbon oxides. Metal from the metal oxide gets reduced to the pure metal.

How are metals more reactive than carbon extracted?

How are metals more reactive than carbon extracted?

By electrolysis.

How are oxidation and reduction defined in terms of electron transfer ?

Higher Tier Only

How are oxidation and reduction defined in terms of electron transfer?

Oxidation – loss of electrons.
Reduction – gain of electrons.

Higher Tier Only

What is the general equation for a reaction between metals and acids? What type of reaction is this?

What is the general equation for a reaction between metals and acids? What type of reaction is this?

Metal + acid → salt + hydrogen

Redox reaction, also a displacement reaction.

Which metals in the reactivity series will react with acid?

Which metals in the reactivity series will react with acid?

Those above hydrogen.

What is the general equation for a neutralisation reaction?

What is the general equation for a neutralisation reaction?

Acid + Base → Salt + Water

What is the general equation for the reaction between metal carbonate and acid?

What is the general equation for the reaction between metal carbonate and acid?

Metal Carbonate + Acid → Salt + Water + Carbon Dioxide

What is the general equation for the reaction between metal oxide and acid?

What is the general equation for the reaction between metal oxide and acid?

Metal Oxide + Acid → Salt + Water

What is a redox reaction?

Higher tier only

What is a redox reaction?

A reaction where both oxidation and reduction occurs

Higher Tier Only

Explain in terms of gain or loss of electrons which species has been oxidised and which species has been reduced when magnesium reacts with hydrochloric acid

Explain in terms of gain or loss of electrons which species has been oxidised and which species has been reduced when magnesium reacts with hydrochloric acid

Magnesium has lost electrons and thus has been oxidised (Mg to Mg^{2+})

The hydrogen in HCl has gained electrons and thus has been reduced (H^+ to H_2)

Higher tier only

How is a soluble salt formed?

How is a soluble salt formed?

a) Add an insoluble base (e.g. metal oxide) to warm acid to form a soluble salt and water until no more base will dissolve (the acid has been completely neutralised).
b) Filter off the leftovers (excess solid base).
c) Heat the solution to evaporate the water then leave the salt to crystallise.

What do acids and alkalis produce in aqueous solutions?

What do acids and alkalis produce in aqueous solutions?

Acids produce hydrogen ions, alkalis produce hydroxide ions.

What are bases, acids and alkalis?

What are bases, acids and alkalis?

- Bases are compounds that neutralise acids to produce a salt.
- Acids are substances that produce hydrogen ions in aqueous solutions.
- Alkalis are soluble bases that produce hydroxide ions in aqueous solutions.

What is the pH scale and what does a pH of 7 show?

What is the pH scale and what does a pH of 7 show?

The measure of acidity/alkalinity of a solution; neutral solution.

State the general equation for a neutralisation reaction in a short, ionic form.

State the general equation for a neutralisation reaction in a short, ionic form.

$H^+ + OH^- \rightarrow H_2O$

What is a strong acid? What is a weak acid?

Higher tier only

What is a strong acid and weak acid?

Strong acid is completely ionised in aqueous solution; weak acid is only partially ionised in aqueous solution.

Higher tier only

What happens to pH as concentration of H^+ increases?

Higher tier only

What happens to pH as concentration of H^+ increases?

It decreases.

Higher tier only

What is a concentrated acid and what is a dilute acid? Is this the same as a strong and weak acid?

Higher tier only

What is a concentrated acid and what is a diluted acid? Is this the same as a strong and weak acid?

Concentrated has more moles of acid per unit volume of water than dilute (dilute refers to solutions of low concentrations).

Not the same - concentration is not the same thing as strength of an acid.

Strength refers to whether the acid is completely ionised in water (strong) or only partially (weak).

Higher tier only

As the pH is decreased by one unit, what change is seen in the hydrogen ion concentration?

Higher tier only

As the pH is decreased by one unit, what change is seen in the hydrogen ion concentration?

Increases by a factor of 10

Higher tier only

Name the following salts:

$LiNO_3$, K_2CO_3, $MgBr_2$, $BaSO_4$

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Lithium nitrate

Potassium carbonate

Magnesium bromide

Barium sulfate

Describe the tests for hydrogen, oxygen, carbon dioxide and chlorine

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Hydrogen – ‘pop’ heard when burning splint placed over the gas.
Oxygen – glowing splint relights.
Carbon dioxide – turns limewater ($Ca(OH)_2$) milky.
Chlorine – bleaches damp blue litmus paper and makes it white.

Describe the flame test results

Describe the flame test results

Lithium compounds - crimson red flame.
Sodium compounds - yellow flame.
Potassium compounds - lilac flame.
Calcium compounds - orange-red flame.
Copper compounds - blue-green flame.

Describe the sodium hydroxide test results and write the equations

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Copper(II) forms a blue precipitate:

$Cu^{2+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow Cu(OH)_{2(s)}$

Iron(II) forms a dirty green precipitate:

$Fe^{2+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow Fe(OH)_{2(s)}$

Iron(III) forms a brown precipitate:

$Fe^{3+}_{(aq)} + 3OH^{-}_{(aq)} \rightarrow Fe(OH)_{3(s)}$

Al^{3+}, Ca^{2+}, Mg^{2+} form white precipitates but only the $Al(OH)_3$ dissolves in excess NaOH to form a colourless solution.

$Ca^{2+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow Ca(OH)_{2(s)}$

$Mg^{2+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow Mg(OH)_{2(s)}$

$Al^{3+}_{(aq)} + 3OH^{-}_{(aq)} \rightarrow Al(OH)_{3(s)}$

Describe the test for carbonate anions

Describe the test for carbonate anions

Add dilute acid, e.g. HCl

Fizzing observed, as CO_2 is evolved.

E.g. $Na_2CO_3 + 2\ HCl \rightarrow 2\ NaCl + H_2O + CO_2$

Describe the test for sulfate anions

Describe sulfate tests and give an equation

Add a solution containing Ba^{2+} cations, e.g. a solution of $BaCl_2$

White precipitate of $BaSO_4$ forms

E.g. $K_2SO_4 + BaCl_2 \rightarrow 2\ KCl + BaSO_4$

(!!!) can also be thought of as a test for barium (II); add sulfates - white precipitate forms.

Describe the proportions of gases in the modern atmosphere

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78% of N_2, 21% of O_2, with small quantities of CO_2, H_2O, and noble gases (mainly Argon).

What is the greenhouse effect? What are greenhouse gases? Give examples

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Greenhouse gases in the atmosphere maintain temperatures on Earth high enough to support life.

They allow short wavelength radiation from the sun to pass through the atmosphere to the Earth's surface, but absorb and reflect back the outgoing long wavelength radiation from the Earth causing an increase in temperature.

Water vapour, carbon dioxide, and methane.

How have human activities led to an increase in greenhouse gases?

How have human activities led to an increase in greenhouse gases?

Carbon dioxide – combustion of fossil fuels and deforestation.
Methane – increased farming and decomposition in landfills.

What are the potential effects of global climate change?

What are the potential effects of global climate change?

- Sea level rise, which may cause flooding and increased coastal erosion.
- Melting of glaciers and polar ice caps.
- More frequent and severe storms.
- Changes in the amount, timing and distribution of rainfall.
- Temperature and water stress for humans and wildlife.
- Changes in the food-producing capacity of some regions.
- Changes to the distribution of wildlife species.

What are the issues regarding sulfur dioxide and oxides of nitrogen?

What are the issues regarding sulfur dioxide and oxides of nitrogen?

Sulfur dioxide and oxides of nitrogen cause respiratory problems in humans and cause acid rain. Acid rain kills animals (by making the lakes in which they live in acidic) and damages plants and buildings.