Instruction: Copy in your chemistry book, and do the activities as indicated

GHA

S.3 CHEMISTRY HOLIDAY WORK TERM III 2023

Project work:

Using any locally available materials, such as beads to represent electrons, wires to represent the shells, design a model to show the formation of the molecule of ammonia from nitrogen and hydrogen

TOPIC: INDUSTRIAL PROCESSES

Competency: *You will be able to appreciate the principles behind some industrial processes and the importance of the products formed.*

After going through the activities in this topic, you should be able to:

a. *know about some of the main industries that produce useful chemicals, such as the oil industry for our organic chemicals, the production of metals, the acid industry, the alkali industry, the fertilizer industry and the cement industry*
b. *understand the processes for obtaining useful chemicals from rocks*
c. *understand the processes involved in extracting and purifying metals, with particular reference to processes used in Uganda*
d. *understand the importance of nitrates as fertilisers in food production and know how they are produced from the nitrogen in the air*
e. *outline four industrial processes that make use of natural resources obtained in Uganda*
f. *recognise the importance of industrial processes in utilising natural resources to make useful chemicals, and appreciate that industrial processes have social benefits and cause problems of pollution and environmental destruction.*
g. *describe some of the dangers to the community arising from these industrial processes and the steps that may be taken to minimise these dangers*
h. *understand the process of the manufacture of lime and cement*
i. *understand the production of alkali and chlorine by the electrolysis of salt solution*
j. *evaluate uses of synthetic polymers*

Instruction: Copy in your chemistry book, and do the activities as indicated

INTRODUCTION

Activity 1

Using the internet or any other source of information such as textbooks, newspapers etc., find out the following:

a) What is a chemical industry?
b) What processes take place in chemical industries?
c) What types of chemical industries do we have in Uganda?

Industrial processes are procedures involving chemical, physical, electrical, or mechanical steps to aid in the manufacturing of an item or items, usually carried out on a very large scale.

During chemical processing, raw materials which can either be non-living eg minerals, or living, eg plants and micro-organisms (collectively known as biomass) are chemically converted into finished products. For example

1. Cotton: used to make clothing and textiles
2. Petroleum: used to make fuels, plastics, and chemicals
3. Iron ore: used to make steel for construction and manufacturing
4. Bauxite: used to make aluminum for construction and manufacturing
5. Wheat: used to make flour for bread and other baked goods
6. Limestone: used to make cement for construction
7. Clay: used to make ceramics and pottery
8. Silicon: used to make computer chips and other electronic components.
9. Seawater : salt, sodium hydroxide, chlorine
10. Air: nitrogen, argon, oxygen

11. Water : purified water and many other chemical reactions require water for reactions
12. Minerals/Rocks: copper, gold, other precious metals
13. Wood: used to make furniture, paper, and construction materials

Chemical industries in Uganda

Activity 2

Using the internet or any other source of information such as textbooks, newspapers etc., find out the following:

a) What are some industries in Uganda?
b) What products do they manufacture?
c) What are the uses of these products in daily life?
d) What is the importance of chemical processes in improving Uganda's economy?

Copy and complete the following table

Common chemical products produced in Uganda	**Main chemical industries that produce the product**	**Uses of the product**
Steel pipes		
Soda and mineral water		
Cement		
Fertilizers		
Soap and detergents		
Sanitizers		
Battery		
Petroleum jerry		

Instruction: Copy in your chemistry book, and do the activities as indicated

Natural resource processing industries

Which industries in Uganda use natural resources?

Which natural resources do they use?

Which products do they produce?

How are they useful?

Natural resource processing means the processing of natural resources, including, plants, animals, fossil fuels, minerals, sand, gravel, coal, limestone, granite and salt.

Many industries use natural resources as raw materials, including:

1. **Agricultural processing industry:** crops and livestock are natural resources used as raw materials in the production of food and beverages.
2. **Mineral processing industry:** minerals, metals, and other materials are extracted from the earth and used in various substances like steel doors, aluminium saucepans etc.
3. **Forestry industry:** trees are harvested and used for lumber and other wood-based products.
4. **Energy processing industry:** fossil fuels, such as coal, oil, and natural gas, are extracted and used to generate electricity and power transportation.
5. **Fishing processing industry:** fish and other seafood are caught and processed for food and other products like fish liver oil
6. **Water purification and treatment industry:** water is a natural resource used by many industries, including agriculture, energy, and manufacturing.
7. **Soap making industry:** Fats and oils from plants and animals are used to make soap used in cleaning fabrics and utensils

OBTAINING USEFUL CHEMICALS FROM ROCKS

We are surrounded by rocks and minerals everywhere; on the ground we walk on, at the places we live and even in food we eat.

There are several useful chemicals founds in rocks. Most rocks are composed of naturally occurring inorganic solids that have a crystalline structure and a distinct chemical composition. These are known as **minerals**.

Study and complete the table below by giving the use(s) of the mineral

Instruction: Copy in your chemistry book, and do the activities as indicated

Mineral	Chemical formula	Use(s)
Silver	Ag	
Copper	Cu	
Graphite	C	
Galena	PbS	
Cuprite	Cu_2S	
Haematite	Fe_2O_3	
Quartz	SiO_2	

Discussion points:

a) Why are sampling and analysis of the rock necessary before mining?
b) State atleast two ways in which sampling is done
c) Compare the manual and excavation (machinery) methods of mining
d) State three properties of the rock which are considered before concentration of rock is done
e) Outline three ways in which the rock can be concentrated

Instruction: Copy in your chemistry book, and do the activities as indicated

Cement and lime industry

Using the chemistry text books or internet, read about the process of making cement and the process of making lime. Use your research to answer the following questions

- What are the raw materials used to make cement?
- How are raw materials treated to obtain cement?
- What is cement used for?
- Which cement industry do we have in Uganda?
- What are the raw materials used to make lime?
- How are raw materials treated to obtain lime?
- What is lime used for?
- Which lime industry do we have in Uganda?

Extraction and purification of metals

Have you ever extracted juice from orange fruits? What processes were involved in purifying the seed free juice? This process can be compared to purification of metals, where the pure metal is separated from other unwanted materials (impurities)

Quick search:

a) How can metals be extracted?
b) State the method that is suitable for extraction of a given metal
c) What do you think is the reason for the suitability of the method chosen for extraction of a given metal?

Instruction: Copy in your chemistry book, and do the activities as indicated

Key points to note:

Reactive metals are not found as free elements in nature, but are found combined with other elements forming **ores.** To isolate the metals from other impurities extraction and purification is done

An ore is a naturally occurring substance from which a metal can be extracted.

For a metal to be extracted, its concentration in a given ore must be high. Therefore, it is necessary to concentrate (purify) the ore before extracting the metal.

The method of metal extraction normally depends on the position of the metal in the electrochemical/reactivity series

Very reactive metals, that is, those higher in the reactivity series occur mainly as chlorides. They are extracted **by electrolysis** of their fused salts. Such metals include potassium, sodium, calcium, magnesium and aluminium.

Metals in the middle of the reactivity series such as **zinc, iron, lead** and **copper** mainly occur as oxides, carbonates and sulphides. They are extracted **by reduction** of the ore.

Metals lower in reactivity series, that is, **mercury, silver** and **gold** mainly **occur as free metals** in the earth's crust. They are mainly dug up in the pure form.

Instruction: Copy in your chemistry book, and do the activities as indicated

Extraction of iron

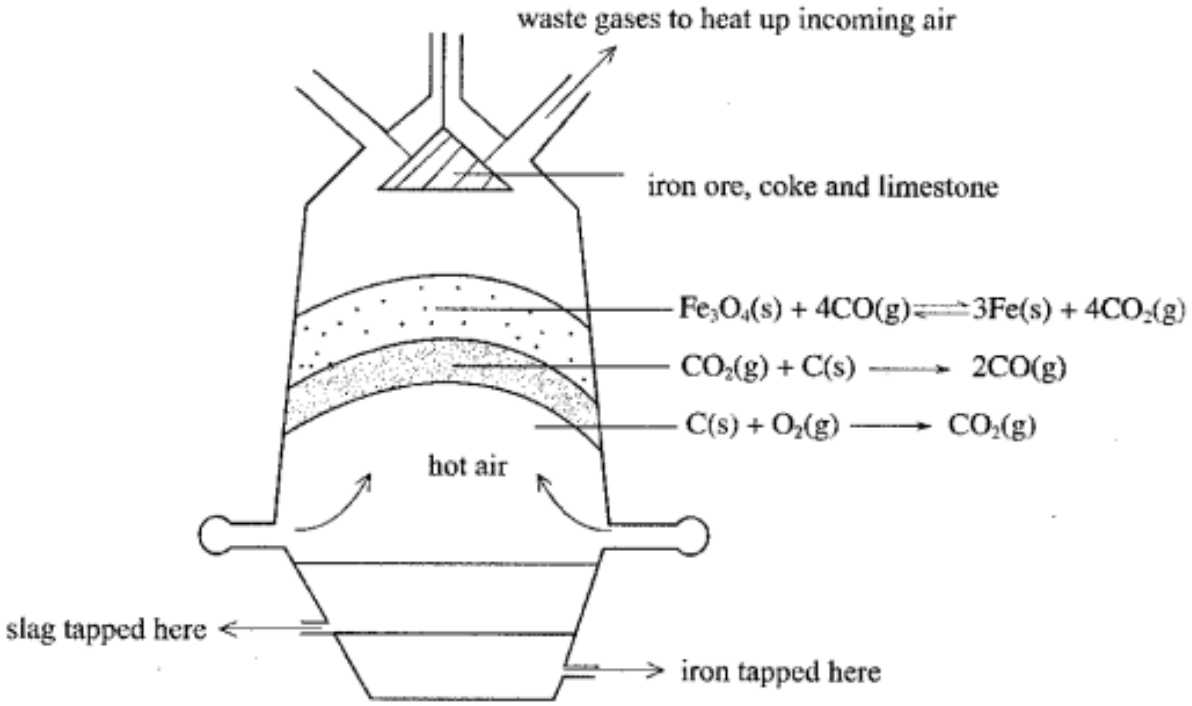
Using the internet or any other source of information such as textbooks, etc., find out the following:

a) Write the formulae and chemical names of the ores of iron
b) Where in Uganda can iron ores be found?
c) Which method is used to extract iron and why is it used?
d) Write down the steps involved in extracting iron from its ores. In your description, write the chemical equations for the reactions involved.
e) Explain the processes involved in purifying iron
f) Summarise the main processes of extraction and purification of iron on a flow chart
g) State the uses of iron in daily life

Did you discover?

- The principle/chief ores of iron are:
  - ✓ Haematite, Fe_2O_3;
  - ✓ Magnetite, Fe_3O_4;
  - ✓ iron disulphide or Iron pyrite, FeS_2;
  - ✓ Siderite or Spathic iron ore ($FeCO_3$);
  - ✓ Limonite ($Fe_2O_3.xH_2O$).
- It is extracted by reduction process since iron is a moderately reactive metal
- Haematite and magnetite are the most commonly used ores for the extraction of pure iron.

Instruction: Copy in your chemistry book, and do the activities as indicated



- The iron ore is crushed and roasted in air to remove water and other non-metallic impurities especially sulphur and phosphorus which are oxidized away as gaseous oxides. The roasted ore is now mainly Fe_3O_4. When an ore is roasted in air and Fe_3O_4 is the main product, it is known as sintering
- The ore is first mixed with coke and limestone and the mixture is fed into the blast furnace from the top of the furnace.
- Hot air is blown into the furnace at the bottom which comes into contact with the red hot coke, producing carbon dioxide.

$$C(s) + O_2(g) \rightarrow CO_2(g)$$

- Higher up the furnace, the source of oxygen is less and more coke combines with carbon dioxide produced to form carbon monoxide.

$$C(s) + CO_2(g) \rightarrow 2CO(g)$$

- Carbon monoxide produced reduces the iron oxides to molten iron.

$$Fe_3O_4(s) + 4CO(g) \rightarrow 3Fe(l) + 4CO_2(g)$$

- ❖ Molten iron runs to the bottom of the furnace and is tapped off into moulds where it is solidified. The moulds are called 'Pigs' and therefore this impure form of iron is called pig-iron.

- Lime stone removes silicon(IV) oxide which is the main impurity in the iron ore. Limestone is decomposed by heat to calcium oxide and carbon dioxide.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

The iron contains impurities such as silicon dioxide (sand), which combine with calcium oxide to form a molten slag that floats on top of the molten iron and it is tapped off.

$$CaO(s) + SiO_2(s) \rightarrow CaSiO_3(l)$$

The slag protects the molten iron against any further oxidation by oxygen in the hot air in the blast furnace.

Calcium silicate/slag is used for making roads, manufacturing cement, manufacturing glass

The wastes gases, mainly nitrogen and oxides of carbon, escape from the top of the furnace.

There are three types of iron which are classified based on their percentage purity. The percentage purity also determines the strength and use of the iron. The types of iron are cast iron (pig iron), wrought iron and steel.

Cast iron(pig iron)

This is an impure iron which contains relatively high proportions of carbon (4%) and small proportions of other substances such as silicon, phosphorus and sulphur. Such impurities make cast iron to be hard, brittle and to have a lower melting point than pure iron. It cannot be welded and has little tensile strength.

Cast iron can be used to make hot water pipes, Bunsen burner bases, cookers, in railings and other purposes where little strain is imposed.

Wrought iron

This is the purest form of iron (contains about 0.3% carbon) and is obtained from cast iron by heating it with iron(III) oxide in a furnace by a process known as —puddling. The oxygen of the iron oxide oxidizes carbon and sulphur to their respective gaseous oxides, phosphorus to Phosphates(V) and silicon to silicates which form slag. The semi molten mass is then hammered and rolled so that the slag is squeezed out and a mass of almost pure iron remains.

It is very tough, malleable and ductile and is therefore used to make iron nails, sheeting, ornamental work, horse shoes and agricultural implements. Wrought iron is sometimes referred to as low carbon steel.

Steel

Steel is an alloy of mainly iron with carbon and other elements like manganese, chromium, silicon, cobalt and sometime tungsten. The quality of steel depends on the amount of carbon present and this in turn determines its intended use.

Steel is generally used in the construction of buildings, bridges, ships, car bodies, cutting and boring tools, crushing machines and stainless cutlery such as knives, forks e.t.c.

Instruction: Copy in your chemistry book, and do the activities as indicated

Extraction of copper

Copper is found mixed with other metals forming ores. There are different ores with different chemical composition

Using internet or relevant chemistry textbooks;

1. Collect information about copper mining
2. Identify the principle ores of copper
3. Where in Uganda can such ores be found?
4. State the main steps involved in extracting copper from its ores.
5. How does copper mining affect the environment?
6. State the uses of copper in everyday life

Did you discover?

The principle/ chief ores of copper are:

- ✓ copper pyrites ($CuFeS_2$);
- ✓ cuprite (Cu_2O);
- ✓ copper(I) sulphide (Cu_2S)
- ✓ malachite ($CuCO_3.Cu(OH)_2$)

Extraction of copper from copper pyrites

The ore is first concentrated by a process of froth floatation and then it is roasted in air to produce copper(I) sulphide.

$2CuFeS_2\ (s) + 4O_2(g) \rightarrow Cu_2S(s) + 3SO_2(g) + 2FeO(s)$

Sulphur dioxide escapes from the top of the furnace.

By adding silicon dioxide, SiO_2, and heating in absence of air, the iron(II) oxide is converted into a slag of iron(II) silicate, $FeSiO_3$, which floats on top of the molten copper(I) sulphide and it is tapped off.

$FeO(s) + SiO_2(s) \rightarrow FeSiO_3(l)$

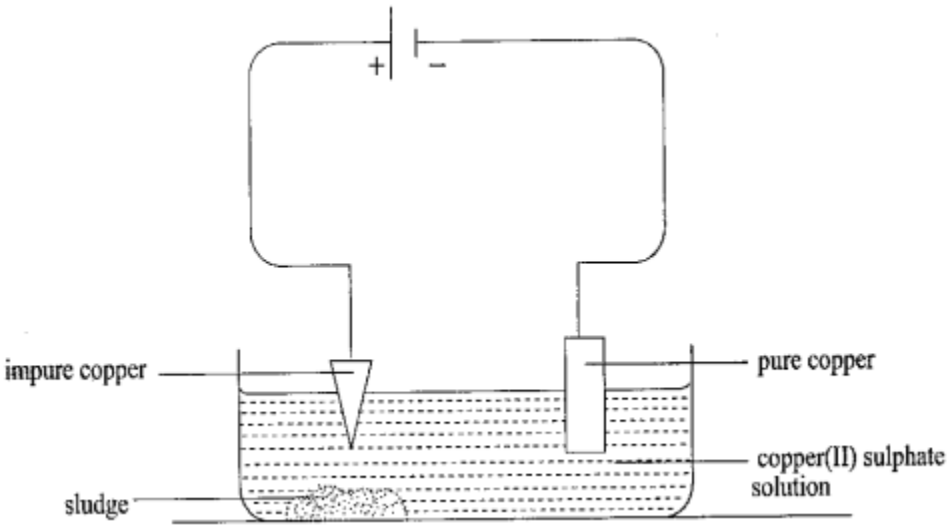
Copper(I) sulphide is reduced to the metal by heating a regulated supply of air (oxygen).

$Cu_2S(s) + O_2(g) \rightarrow 2Cu(s) + SO_2(g)$

This copper produced is impure and is called blister copper and has to be purified. Purification of the copper is done by the process of electrolysis.

Purification of the impure copper

The impure copper is purified (refined) by electrolytic process using copper(II) sulphate solution as the electrolyte. The cathode is pure copper and the impure copper is made the anode as shown in figure below



During electrolysis, the copper atoms of the anode lose electrons to form copper(II) ions which dissolve in the solution.

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

Then the copper(II) ions are attracted to the cathode where they gain electrons and become copper atoms.

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

The overall effect is that copper gradually dissolves from the anode and is deposited on the cathode.

Therefore, the anode dissolves and decreases in size as the cathode grows bigger (increases in size).

Copper from the cathode is removed by stripping.

Impurities which are higher than copper in the activity series, such as iron, also dissolve from the anode but are not deposited on the cathode. They accumulate in solution in the electrolyte.

Impurities which are lower than copper in the activity series do not dissolve at all. They fall to the bottom of the container as sludge. The elements which were present in the original copper ore

Uses of copper

1. Copper is used as a conductor of electric power in wires and cables.
2. It is used for making alloys like bronze (copper and tin) and brass (copper and zinc),copper coinage (copper and tin), German silver (copper, zinc and nickel)
3. It is used for making water pipes and boilers
4. Used for making roofing sheets because it is corrosion resistant.
5. It is used for making ornaments like ear rings and pins, bungles etc. being little attacked by air

Health and pollution problems associated with extraction of copper

It is important to note that the sulphur dioxide evolved from the extraction copper is a pollutant to the environment and therefore methods to control its discharge to the environment should be sought. Sulphur dioxide being an acidic oxide dissolves in water to form

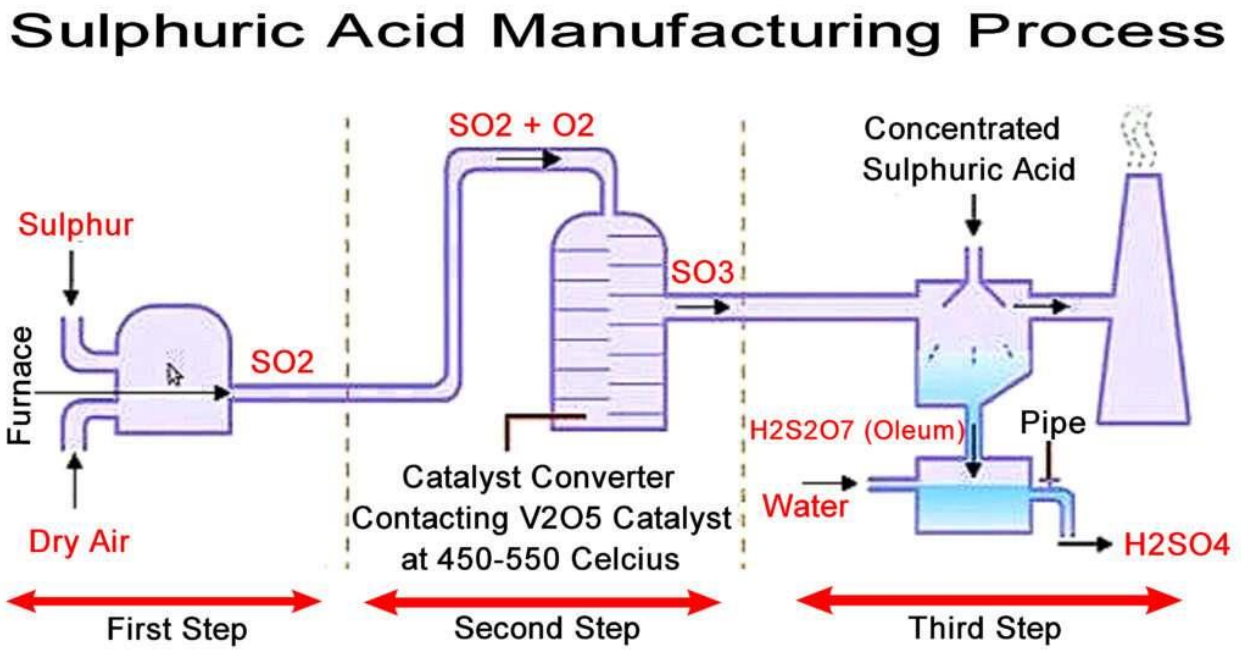
sulphurous acid '**acid rain**'. This affects certain plants and fish in the water which receive acid rain. Respiratory ailments such as nasal and throat irritation are common in these areas where copper is smelted.

Control of this environmental pollution

The amount of sulphur dioxide emitted during this extraction of copper can be controlled by:

(i) Bubbling the gas through an alkali solution, for instance sodium hydroxide

(ii) Building a sulphuric acid manufacturing plant. By the **contact process**, The sulphur dioxide can be converted to sulphurtrioxide that is then dissolved in concentrated sulphuric acid to form oleum



In the contact process sulphur dioxide, SO_2 is oxidized to **sulphur trioxide** (SO_3) at high temperature (about 450°C) in the presence of a **vanadium (V) oxide** as a catalyst. SO_3 then is dissolved in concentrated sulphuric acid

forming fuming sulphuric acid (oleum). This can then be reacted safely with water to produce concentrated sulphuric acid.

$S(s) + O_2(g) \rightarrow SO_2(g)$

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

$H_2SO_4 + SO_3(g) \rightarrow H_2S_2O_7(l)$

$H_2S_2O_7(l) + H_2O(l) \rightarrow 2H_2SO_4$

Note: Sulphur trioxide cannot be dissolved in water directly as it leads to the formation of fog.

Uses of Sulphuric Acid

- turn used to make fertilizers.
- is used in the making of fibres.
- Used in acidic drain cleaners.
- Due to its strong dehydrating property, it can be used to remove the tissue paper.
- Used as a catalyst in the manufacturing process of nylon.
- Used in petroleum refining.

Common Acids Used in Industry:

Acids are an important part of many industries, from food and beverage to pharmaceuticals. You may be wondering, what are the simplest industrial acids, and how are they used?

How are industrial acids produced?

Acids used for industrial purposes are usually synthesized and not extracted from natural products like plants or animals.

Important properties of Industrial Acids

A few important properties of the common acids used in industry are:

- They have a sour taste and smell
- They are soluble in water
- They react readily with most metals
- They are corrosive

What are the common acids used in industry?

The five most common acids used in industry are hydrochloric acid, phosphoric acid, nitric acid, sulphuric acid, and acetic acid.

Hydrochloric Acid: It is also known as aqueous hydrogen chloride. The chemical formula of hydrochloric acid is HCl. Hydrochloric acid is primarily used as a cleaning agent to remove grease and soil from surfaces or to remove rust or other corrosion products from metal objects. It's also used in some manufacturing processes, such as paper production.

Phosphoric Acid: Phosphoric Acid is used as a traditional method of removing rust from metals by submerging the metal in a phosphoric acid bath. It can also be used to create fertilizers or make polymers to produce plastics.

Nitric Acid: Nitric Acid is used in the food industry to sterilize canned foods because it kills bacteria that would otherwise spoil food.

Sulphuric Acid: Sulphuric acids are often used as wastewater treatment agents because they break down contaminants like heavy metals or chemical pollutants into inert compounds like chalk or gypsum.

Acetic Acid: Acetic acid is an organic compound that exists naturally in vinegar (acetic acid), fermented foods like wine, cheese, or yogurt (acetic acid), and fruits like apples (malic acid).

Conclusion

The five common acids used in industry are manufactured and used in various industries to create a chemical reaction. They are most often used to produce drugs, detergents, and synthetic fibers.

Extraction of aluminium from its principal ore

Research and make notes about on the following

a) Write the formulae and chemical name of the common ores of aluminium
b) Which method is used to obtain aluminium from its ores and why it is used?
c) Describe the process of obtaining pure aluminium from its ores
d) Mention the uses of aluminium

Did you discover?

The **Ore** of Aluminium **is Bauxite**, $Al_2O_3.2H_2O$

The oxide, occurring naturally as bauxite, $Al_2O_3.2H_2O$, usually contains silica and iron(III) oxide as impurities. These must be removed first

Extraction of Aluminium is done by **electrolysis** of the fused ore. The ions in the aluminium oxide must be free to move so that electricity can pass through it

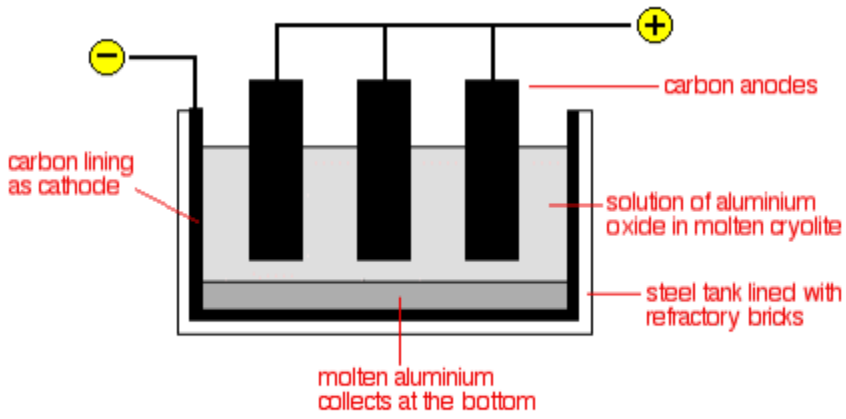
The pure aluminium oxide is first dissolved in molten cryolite (sodium aluminium fluoride - Na_3AlF_6) to lower its melting point.

The melt is then electrolyzed at a temperature between 800-900°C at a high current density between graphite electrodes.

Molten aluminium sinks to the bottom at the cathode where it is tapped off while oxygen is liberated at the carbon anode.

Cathode: $Al^{3+}(l) + 3e^- \rightarrow Al(l)$

Anode: $2O^{2-}(l) \rightarrow O_2(g) + 4e^-$



(e) Uses of aluminium in relation to its properties

Property	***Related use***
Lightness and a high tensile strength	*Used to make alloys like Duralumin for air craft construction, aluminium bronze and magnalum*
Light, good appearance, good heat conductivity	*Making cooking utensils*
Light	*Making overhead electric cables*
Resistant to corrosion	*Construction of windows and doors*
Malleable(easily shaped or bent), ductile and light	*Making aluminium foil used in packaging industry*
Reducing property	*In Thermite welding and extraction of manganese and chromium*

Instruction: Copy in your chemistry book, and do the activities as indicated

Alkali industry

You previously learnt about alkalis and identified sodium hydroxide as one of them.

Sodium hydroxide (caustic soda) is the principle product of the alkali industry. Sodium hydroxide is mainly used in the manufacture of pulp and paper, soap and detergents, petroleum products etc.

During the manufacture of sodium hydroxide, chlorine gas is also produced

Activity: investigate the process of manufacturing sodium hydroxide and chlorine

Use the internet or text book to research on the process of manufacturing chlorine and sodium hydroxide. Focus on the following

a) What is/are the raw material(s) used in the manufacture of sodium hydroxide and chlorine
b) In which areas is/are raw material(s) found in Uganda?
c) Outline the steps involved in manufacture of sodium hydroxide and chlorine
d) Write equations involved in manufacture of sodium hydroxide and chlorine
e) What are the uses of chlorine gas

In the manufacture of sodium hydroxide, **concentrated sodium chloride solution (brine)** is electrolysed using **a graphite (carbon) anode** and a flowing **mercury cathode**.

The chloride ions move to the anode and lose electrons to form neutral atoms of the non-metal chlorine. This is an oxidation process. The chlorine atoms combine by covalent bonding to form chlorine molecules

Reaction at anode: $2Cl^-(aq) \rightarrow Cl_2(g) + 2e$

Chlorine gas obtained is collected in cylinders

Sodium ions move to the cathode and react by gaining electrons to form neutral atoms of the metal sodium. This is a reduction process

Sodium ion is discharged because it requires less energy than the discharge of hydrogen ions in case a mercury cathode is used

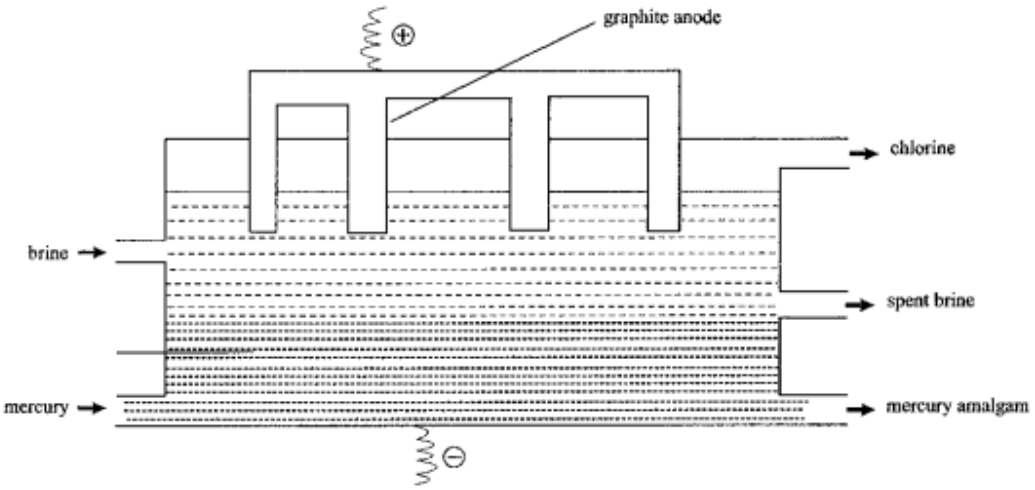
Reaction at cathode: $Na^+(aq) + e^- \rightarrow Na(s)$

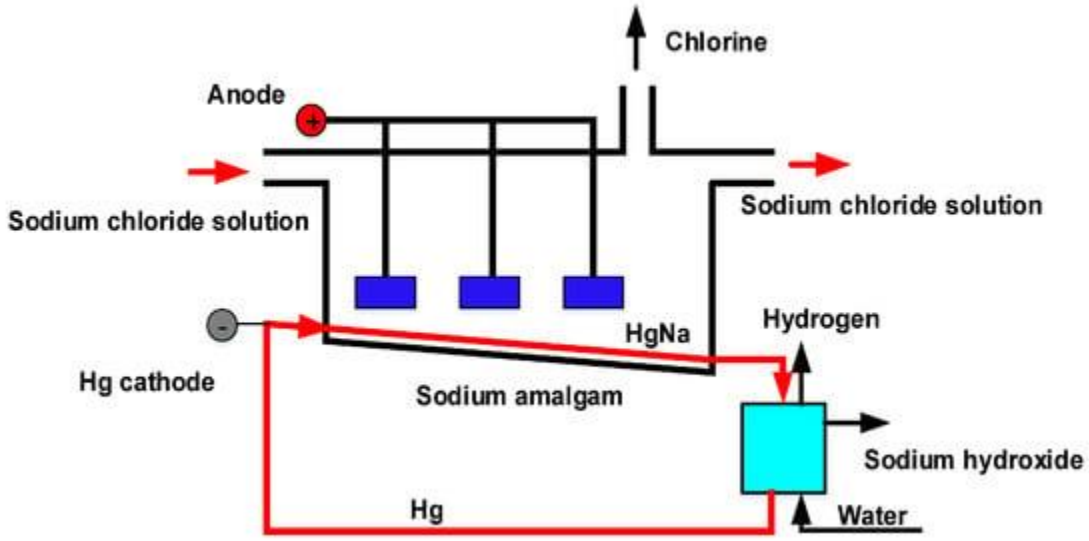
The sodium formed dissolves in the mercury cathode to form a solution called sodium amalgam. The amalgam is mixed with water producing sodium hydroxide solution, hydrogen and pure mercury

$2NaHg(l) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g) + 2Hg(l)$

Mercury is then recycled by use of a pump. Hydrogen is collected as a by-product.

Sodium hydroxide is used in the manufacture of soap, rayon, paper and in the purification of bauxite for aluminium extraction.





Uses of chlorine

1. It is used as a bleaching agent. It is used in paper industry and textile industry to bleach wood pulp and cotton respectively.
2. It is used in the manufacture of inorganic compounds such as hydrochloric acid
3. Chlorine is used to kill micro-organisms during sewage and water treatment.
4. It is used in manufacture of plastics such as polychloroethene or polyvinyl chloride.
5. In the manufacture of weed killers and insecticides

Agro-chemical industry

Chemicals used in agriculture including chemical fertilizers, herbicides, insecticides are called Agro-Chemicals.

Agro chemical industries provide a driving force on agricultural production. Fertilizers produced by agro-chemicals improve on production for farmers in less fertile areas.

Why are there different fertilizers?
How do fertilizers improve agricultural yields?

Nitrogen is the main constituent of air and is essential for living organisms. Plants require nitrogen to grow. Animals obtain by feeding on plants.

However, nitrogen gas must be converted into nitrates that can be used by plants and animals as sources of nitrogen.

Nitrogen fertilizers include many types of solid and liquid products among which the most common ones are ammonia, ammonium nitrate and urea

Activity: Use the internet or chemistry text books to research and take notes on the following

a) Explain the difference between nitrogen-fixing and denitrification
b) Starting from the atmospheric air, describe how nitrates are obtained from nitrogen
c) Briefly explain how nitrates are converted into fertilizers

Instruction: Copy in your chemistry book, and do the activities as indicated

Did you discover?

- The difference between nitrogen fixation and denitrification is that nitrogen fixation is the process in which converts molecular nitrogen (N_2) to ammonia(NH_3) or other nitrogenous compounds. Denitrification is the opposite in that nitrates are reduced to produce molecular nitrogen. The nitrates are converted back to atmospheric nitrogen.

- For nitrogen-based fertilizers, the largest product group, the process starts by mixing nitrogen from the air with hydrogen from natural gas at high temperature and pressure to create ammonia.

- By the **Haber process**, the nitrogen and hydrogen are mixed in a 1:3 ratios, compressed (pressure between 200-1000atm) and heated (temperature between 670-770K) with a catalyst (finely divided iron). This causes some of the nitrogen and hydrogen to combine to form ammonia.

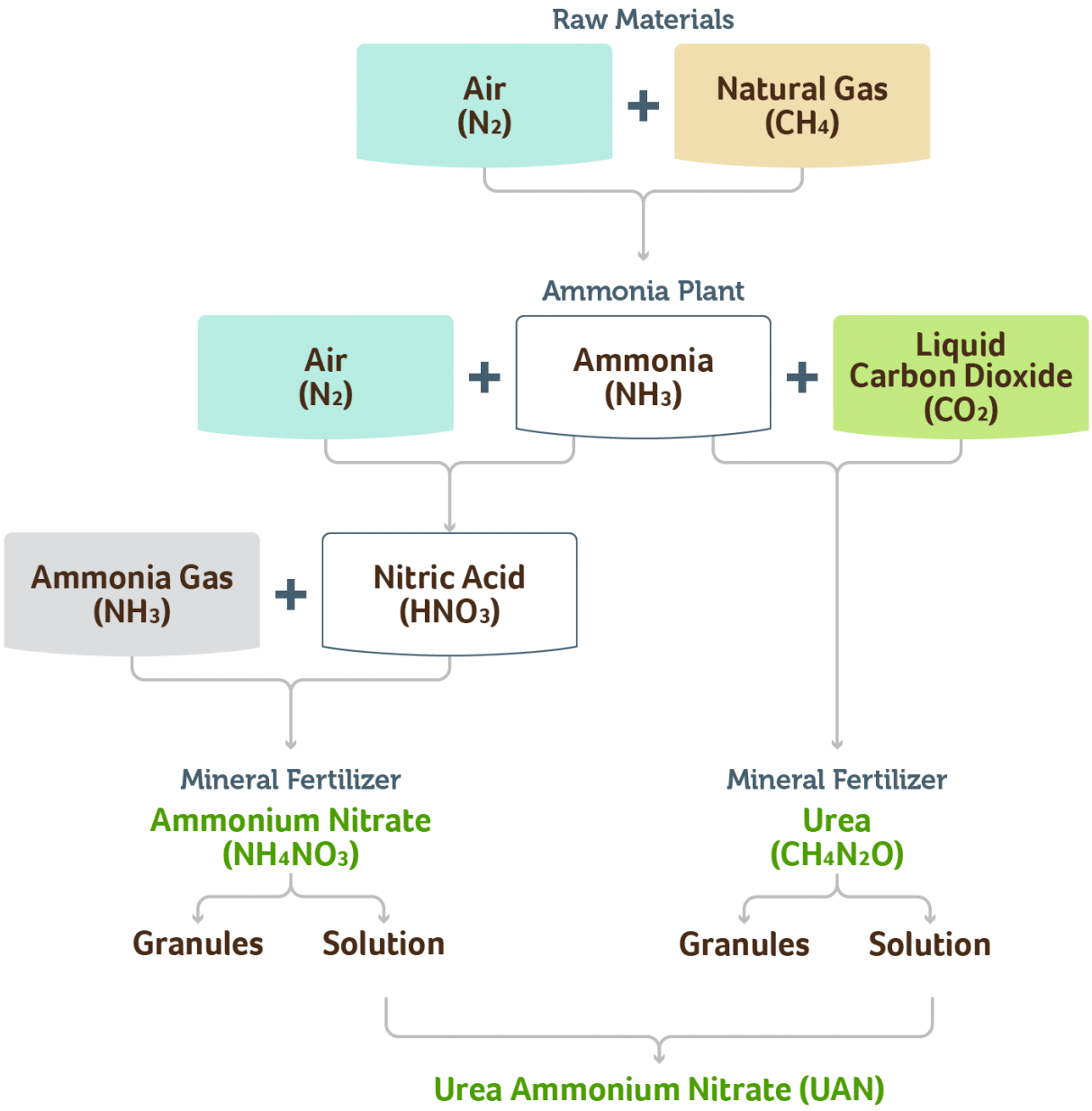
  $\mathbf{N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)}$

- The ammonia is used to make nitric acid (by catalytic oxidation of ammonia followed by the absorption of the nitric oxide gas in water).

  Nitric acid can be used to make compounds such as potassium nitrate and can also be reacted with ammonia to form ammonium nitrate (AN).

- Ammonia may also be mixed with liquid carbon dioxide to create urea. Both these products can be further mixed together with water to form UAN (urea ammonium nitrate) solution.

Instruction: Copy in your chemistry book, and do the activities as indicated



- Based on the two main end products, ammonium nitrate and urea, different fertilizer types are manufactured by mixing with ingredients such as phosphorus and potassium to form NPKs, dolomite to form CAN, or by mixing urea and ammonium nitrate solution to make UAN.

Instruction: Copy in your chemistry book, and do the activities as indicated

Polymer industry

Activity:
Using the reading material or the internet make research on natural and synthetic polymers. In your research focus on their differences, examples, methods of disposal, uses and the environmental effects of synthetic polymers

Did you discover?

Polymer is a class of natural or synthetic substances composed of very large molecules that are multiples of simpler chemical units called monomers.

Natural Polymers

They occur naturally and are found in plants and animals. For example, proteins, starch, cellulose and rubber.

All four of the main classes of biological molecules (nucleic acids, proteins, carbohydrates, lipids) include polymers. Most of the natural polymers encountered in everyday life are proteins, such as keratin in wool and hair; cellulose from plants; and collagen in skin.

Synthetic Polymers

These are human-made polymers. Plastic is the most common and widely used synthetic polymer. It is used in industries and various dairy products.

Examples of synthetic polymers include:

- Bakelite, the first synthetic plastic
- Nylon

- Polyester
- Polyethylene
- Polypropylene
- Polystyrene
- Rayon
- Teflon
- Epoxy resin

Commercial Uses of Polymers

Polymer	**Uses of Polymer**
	Used in manufacture of
Polyethylene	plastic bags and film wraps, bottles, electrical insulation, toys, etc
Polyester	clothing, upholstery, and carpets.
Rubber	tyres, elastic materials
Polypropylene	ropes, sacks, and bottles
Terylene	Fabric
Bakelite	Plastic switches, Mugs, buckets
Poly vinyl chloride PVC	Tubes, Pipes
Melamine Formaldehyde Resin	Ceramic, plastic material
Nylon-6	Fabric

Environmental issues Caused by Synthetic Polymers

The non-biodegradable nature of synthetic polymers makes them a permanent waste. They cause water and land pollutions. When the polymeric wastes are dumped into the oceans can have a devastating effect on ecosystems

Most polymers are not biodegradable. Burning and heating during cooking of polymers may release toxic chemicals into the atmosphere.

Improper disposal of materials can present a hazard to animals
Last a long time when disposed of in a landfill dumping.

Advantage: Polymers can be easily reused and recycled. They can be used to create numerous unique and useful materials (plastics) some of which have uses for which there is no natural substitute. Chemically inactive, materials stored in plastic are not damaged by their contact with the plastic.

Importance of chemical industry

You do or do not realize that chemical industries are a part of your life. No, it does not need you to work in a chemical factory. Knowingly or unknowingly, you use chemically produced items each day in your daily life.

Using the knowledge acquired from previous sections of the topic,

a) Identify the importance of the chemical industry
b) What dangers do chemical industries have on the community?
c) How do the dangers affect the people and the environment?
d) Suggest the ways how the problems associated with chemical industries can be solved

Did you discover?

The raw materials used in our everyday life products are processed chemically in chemical factories. The **chemical industry** is a widespread business all across the world.

From agriculture, science and technology, food, decor, transportation, communication, and much more, the chemical industry plays the lead role.

The areas that are prime for chemical innovation include

- better measurements for life-cycle assessments;
- enhancement of recycling technologies and co-design of plastic products for recyclability;

- Synthesis and Production of Drugs
- carbon capture, utilization, and storage;
- monitoring and improving air quality;
- monitoring and improving water safety; and
- monitoring and improving food safety.
- Production of Personal Care Products
- Production of Fertilizers and Pesticides

Dangers associates with chemical industries and their solutions

Chemical manufacturing has a significant impact on the environment, including air and water pollution, soil contamination, greenhouse gas emissions, and the depletion of natural resources. The production and use of chemicals contribute to climate change and can harm human health, wildlife, and ecosystems.

Many chemicals are hazardous to the environment. This can be in the form of gas and heat emissions released into the air; toxins seeping into landfill and waterways; or damage caused by fires, explosions and chemical reactions which spread outside the worksite.

Solutions for Reducing the Environmental Impact

Several solutions can help to reduce the environmental impact of chemical production:

1. **Recycling and Reuse**: Recycling and reusing materials can help to reduce waste and conserve resources. By implementing recycling programs and reusing materials in production processes, companies can reduce the amount of waste they generate and minimize their environmental impact.

2. **Energy Efficiency**: Improving production processes' energy efficiency can help reduce greenhouse gas emissions and lower energy costs. By implementing measures such as energy-efficient lighting, equipment, and production processes, companies can reduce their energy consumption and improve their environmental performance.
3. **Material Substitution**: Substituting hazardous materials with safer alternatives can help reduce chemical production's environmental impact. By using safer chemicals and materials, companies can reduce the risks associated with the production and use of their products.
4. **Life Cycle Assessment (LCA)**: LCA can be used to identify areas where the environmental impact of chemical production can be reduced. By analyzing the environmental impact of a product or process throughout its entire life cycle, companies can identify areas for improvement and develop more sustainable production processes.

End of chapter

Merry x-mass & Happy 2024