Metals and Plastics

Chapter 33
Science Matters
Lesson Objectives

• **OC6**  Recall that metals conduct electricity and heat

• **OC7**  Identify everyday applications of metals, for example in industry, in the making of jewellery

• **OC10**  Understand that metals are shiny (lustrous), can be beaten into shape (malleable) and can be stretched (ductile)

• **OC11**  Understand that solder, steel, brass and bronze are alloys, and state one use of each alloy
Homework

• Questions at end of chapter
Key Words

- conductors
- Ductile
- malleable
- Magnetic
- Alloy
- Alkali
- Corrosion
- Galvanising
- Polythene
Metals and Non Metals

Divided into Metals and non Metals
Uses of Metals

• Clocks
• Light Switch
• Light Bulbs
• Copper Pipes
• Pots and Pans
• Knifes, Spoons and Forks
• Cars
• Doors
Properties of Metals

• Hard
• Good conductors of electricity and Heat
• Can be pulled thin into wire (Ductile) and hammered (malleable)
• Usually High Density
• Shiny
• High Melting points and Boiling points
• Some are magnetic
• Sonarous
Properties of Non-Metals

• Soft...easy to cut
• Poor conductors of electricity and Heat
• Break or shatter when hammered or stretched
• Usually Low Density
• Dull Appearance
• Low Melting points and Boiling points
• Non are magnetic
Metals are good conductors
Non Metals Do Not conduct

Fig. 28.3(b)
Examples

• Metals
  • Copper
  • Silver
  • Zinc

• Non-Metals
  • Helium
  • Nitrogen
  • Carbon
Exception

Carbon is a non-metal but a good conductor of electricity.
Test for Metal

Does it conduct electricity?
Homework

• Questions at end of chapter
An Alloy is a mixture of Metals

Some alloys contain the non-Metal Carbon
Alloys

1. Brass (Copper & Zinc)
2. Bronze (Copper & Tin)
3. Steel (Iron & Carbon)
4. Solder (Lead & Tin)
Uses of Alloys

• Brass (Copper & Zinc)
  – Musical Instruments

• Bronze (Copper & Tin)
  – Statues

• Steel (Iron & Carbon)
  – Buildings and Bridges

• Solder (Lead & Tin)
  – Building electrical circuits
Benefits of Alloys

• Generally have different properties than their individual elements
  – e.g. Steel is made from Iron and Carbon is much stronger than either element on its own
CORROSION OF METALS
Lesson Objectives

• **OC45** Understand that rusting is a chemical process that changes iron into a new substance

• **OC46** Carry out an experiment to demonstrate that oxygen and water are necessary for rusting

• **OC47** List three examples of methods of rust prevention: paint, oil, galvanising
Corrosion of Metals

• Corrosion of Iron and Steel is called Rusting
• Rust forms when iron reacts with oxygen and water in the air

• Corrosion – a Definition

Corrosion is any undesired process in which a metal is converted to one of its compounds
Corrosion of Metals

• When Corrosion occurs the metal reacts with water, oxygen and other chemicals in its environment

• The reaction forms metal compounds
  – Silver spoons tarnish
    • Due to the reaction of silver with the air
  – Iron or steel reacts with oxygen and water to form iron oxide (Rust)
Rustling

• Iron or steel reacts with oxygen and water to form iron oxide (Rust)

Iron + Oxygen + Water → Iron Oxide
Rusting

• Not all metals rust

• Gold is very unreactive and does not react with water or oxygen in the air
Investigation

To carry out an experiment to demonstrate that oxygen and water are necessary for rusting
1. Nail in contact with air and water
2. Nail in contact with air but not water
3. Nail in contact with water but not air

Calcium chloride to remove water from the air
How is Rusting Prevented

• Painting
  – PREVENTs OXYGEN AND WATER COMING INTO CONTACT WITH THE METAL

• Oiling and Greasing
  – PREVENTs OXYGEN AND WATER COMING INTO CONTACT WITH THE METAL

• Galvanising
  – Zinc does not corrode
Homework

- Questions at end of chapter
ALKALI METALS

- Lithium
- Sodium
- Potassium
- Rubidium
- Cesium
- Francium
WHAT CAN YOU TELL ME?
Lesson Objectives

- **OC48** Describe the general properties of the alkali metals and understand that alkali metals are in Group 1 of the Periodic Table and have similar properties.

- **OC49** Describe the reactions of the alkali metals with air and water (word equations).
Words to look out for

Alkali
Lithium (Li)
Sodium (Na)
Potassium (K)
Reactive
Hydroxide
Alkali Metals

• **Group 1 Elements** - You need to know

  – Lithium
  – Sodium
  – Potassium
Physical Properties of Alkali Metals

- Easy to cut with a knife
- Good Conductors of electricity
- Low density (float on water)
- Low melting point
Alkali Metals

• These elements are so reactive you cannot find them lying around like silver or gold.

• They react too quickly and combine with other elements
Chemical Properties of Alkali Metals

• Two on the Junior Cert
  • Reaction with Air and Water

  – In all their chemical reactions the Alkali metals lose their outer electron

  – Alkali metals are very reactive
In this example Na (2,8,1) loses one electron making it stable (2,8) and Chlorine (2,8,7) gains one on making it stable (2,8,8)
Reactions with Air

- They lose their shiny appearance when exposed to air (tarnished).
- They are stored under oil because they react so easily with oxygen and become a white powder.
Reactions with Air

Sodium + Oxygen $\rightarrow$ Sodium Oxide

Potassium + Oxygen $\rightarrow$ Potassium Oxide
Reactions with Water

Lithium + Water $\rightarrow$ Lithium Hydroxide + Hydrogen Gas

• On contact with water lithium metals react but not so violently
Reactions with Water

- On contact with water, Sodium metals react violently giving off a gas called hydrogen and a solution of Sodium hydroxide is formed.
- Turns Red litmus paper Blue.
Reactions with Water

Potassium + Water → Potassium Hydroxide + Hydrogen Gas

• On contact with water Potassium metals also react violently giving off a gas called hydrogen and a solution of Potassium hydroxide is formed.
• We also see sparks
Uses of the Alkali metals

- Lithium used in batteries
- Sodium used for street lighting
- Potassium used in Fertilisers
Homework

• Questions at end of chapter
REACTIONS OF METALS

The activity Series

REATIONS OF METALS
Lesson Objectives

• **OC51**  Investigate the reaction between zinc and HCl, and test for hydrogen (word equation and chemical equation)

• **OC52**  Investigate the relative reactivities of Ca, Mg, Zn, and Cu based on their reactions with water and acid (equations not required)
To investigate the reaction between Zinc and Hydrochloric Acid and (b) to test for hydrogen
Reaction of Zinc with HCl

**Acid + Metal >> Salt + Hydrogen**
Experiment

• Title
  • To investigate the reaction between Zinc and Hydrochloric Acid and (b) to test for hydrogen

• Aim
  – To prove that zinc reacts with acid to produce hydrogen gas

• Apparatus
  – Dropping Funnel, Buchner funnel, tubing, test tubes, beehive shelf, stoppers, Tapers Hydrochloric acid, Zinc Granules, water, Copper Sulfate Solution
Experiment

• **Method** - To investigate the reaction between Zinc and Hydrochloric Acid
  
  – Set up as shown in diagram (draw Diagram)
  
  – Allow HCl to drop onto zinc and collect Hydrogen gas in upturned test tube
  
  – After gas has filled the tube remove and stopper
Experiment

• **Method** - to test for hydrogen
  – Set up as shown in diagram (draw Diagram)
  – Light a taper and put to mouth of tube

• **Result**
Q. Why do we use an upturned test tube to collect the hydrogen?

A. Because Hydrogen is lighter than air.
Q. Why do we need to wait for a minute after the HCl drops on the Zinc?

A. To Displace the air in the flask
Q. Why do we use an upturned test tube to light the hydrogen?

A. Because Hydrogen is lighter than air and would escape.
Q. What sound do we hear if the hydrogen mixes with air

A. A very loud POP
Investigation

To investigate the relative reactivities of four metals with (a) water and (b) acid
QUESTIONS AFTER THE EXPERIMENT
Q. Why do we need to sandpaper the magnesium before the experiment?

A. Because magnesium reacts with air to form a coating.
Q. How do we detect if hydrogen gas is present

A. We use a lighted taper to burn the gas
Q. What sound does the gas make when it burns?

A. A squeaky pop
Homework

• Questions at end of chapter
Plastics
Lesson Objectives

• **OC58** Identify everyday applications of plastics, and understand that crude oil products are the raw material for their production

• **OC59** Relate the properties of plastics to their use

• **OC60** Describe and discuss the impact of non-biodegradable plastics on the environment

• **OC61** Understand that chemistry has an important role in pharmacy, medicine and the food industry.
Plastics

• First used to describe substances that become soft when warm

• Means....able to have its shape changed easily

• Man made materials from Crude Oil - Polymerisation
Properties of plastics and their uses

Approx 4% of products from oil refineries go to make plastics

1. Can be moulded into different shapes
2. Easy to maintain as they do not rust or degrade
3. Inexpensive
4. Good Insulators
5. Low Density
• Common Plastics
  – Polythene
    • (plastic bags),
  – Polystyrene,
    • Packaging and cups
  – Polypropylene,
    • Bottles and chairs
  – Nylon,
    • Clothing
  – Polyvinyl chloride (PVC)
    • pipes
Relating the properties to their use

1. Can be moulded into different shapes
2. Easy to maintain as they do not rust or degrade
3. Good Insulators
4. Low Density

1. Lots of different things....Buckets, Bottles, Chairs, Pens etc....
2. Doors and Windows
3. Covering for electrical cables
4. Replacement for glass
Plastics

• Plastics have been around since 1862 but PVC only for about 80 years
  – Polythene...discovered 1933
    • Lunch boxes, shopping bags, rubbish bins
  – Teflon ... Anon stick plastic discovered in 1938
    • Most invented during war time
Plastics and the environment

• Plastics are non biodegradable
  – They are **not** broken down in the environment by Micro-organisms
  – **They do not rot**
  – Also when they burn they give off poisonous gases...causing air pollution
Plastics and the environment

Plastic is a large cause of litter problems...but new production methods mean they can be recycled into other materials.
Homework

- Questions at end of chapter