Metals.

Exercise 1:

Make a list of all the different metals that you know about.

Metals.

Two main groups,

1.Ferrous.

2.Non-Ferrous.

Metals

Ferrous

Pure Ferrous Metals

Iron

Ferrous Alloys

Steel

High Speed Steel

Non Ferrous

Pure Non Ferrous Metals

Copper

Alum.

Zinc

Tin

Lead

Silver

Gold

Mercury

Non Ferrous Alloys

Brass

Copper + Zinc

Bronze

Copper + Tin

Solder

Lead + Tin

High Speed Steel Cutting Tools

Mercury is the only non ferrous metal that is liquid at room temperature.

Alloying.

Ferrous Metals.

<u>Ferrous metals</u>:
Ferrous metals are metals that consist mostly of iron and small amounts of other elements. Ferrous metals are prone to rusting if exposed to moisture. Ferrous metals can also be picked up by a magnet. The rusting and magnetic properties in ferrous metals are both down due to the iron. Typical ferrous metals include mild steel, cast iron and steel.

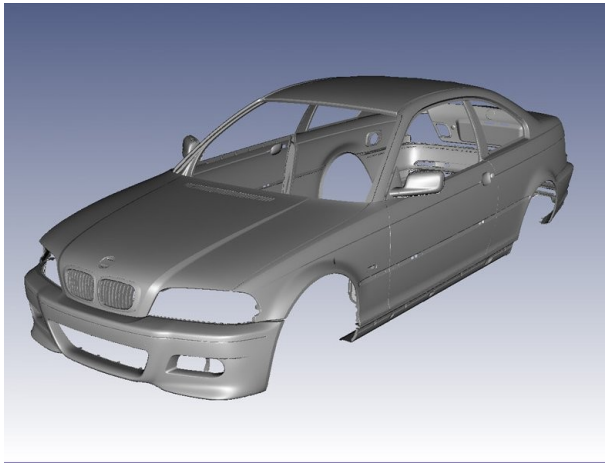
<u>Examples</u>:
1.Mild Steel.
2.Cast Iron.
3.High Carbon Steel.
4.High Speed Steel.
5.Stainless Steel.

Rusting.

Magnetism.

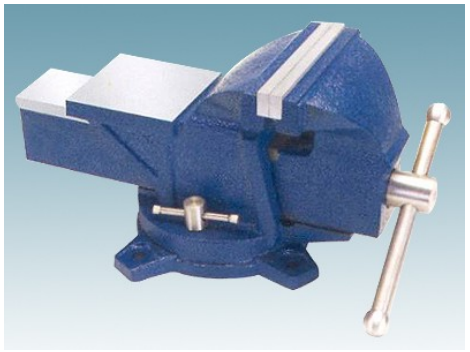
Ferrous Metals.

Metal Type.	Metal Uses.	Melting Point.
Mild Steel. A ductile and malleable metal. Mild steel will rust quickly if it is in frequent contact with water.	Used as Nuts and bolts, Building girders, car bodies, gates, etc.	1600°C



Ferrous Metals.

Metal Type.	Metal Uses.	Melting Point.
Cast Iron. **Is a very strong metal when it is in compression and is also very brittle. It consists of 93% iron and 4% carbon plus other elements.**	**Used as car Brake discs, car cylinders, metalwork vices, manhole covers, machinery bases eg: The pillar drill.**	**1200°C**



Ferrous Metals.

Metal Type.	Metal Uses.	Melting Point.
High Carbon Steel . **It is a very strong and very hard steel that has a high resistance to abrasion. Properties – Up to 1.5% carbon content. Very tough.**	**Used for hand tools such as screwdrivers, hammers, chisels, saws, springs and garden tools.**	**1800°C**

Ferrous Metals.

Metal Type.	Metal Uses.	Melting Point.
High Speed Steel. **HSS is a metal containing a high content of tungsten, chromium and vanadium. However it is very brittle but is also very resistant to wear.**	**Used for drill bits and lathe cutting tools. It is used where high speeds and high temperatures are created.**	**1400°C**

Ferrous Metals.

Metal Type.	Metal Uses.	Melting Point.
Stainless Steel. **Stainless steel is very resistant to wear and water corrosion and rust.** **Properties – It is an alloy of iron with a typical 18% chromium 8% nickel and 8% magnesium content.**	**Used for kitchen sinks, cutlery, teapots, cookware and surgical instruments.**	**1400°C**

Classwork /Homework.

1). What are the properties of a ferrous metal?

2.) What is cast iron used for?

3.) Why is it good to make hammers out of high carbon steel?

4.) Why is it good to make cutlery out of stainless steel?

5.) List one application and one property of the following alloy steels:

(i) Stainless Steel;

(ii) High Speed Steel.

Non – Ferrous Metal.

<u>Non-Ferrous Metals</u>:
Non-ferrous metals are metals that do not have any iron in them at all. This means that Non-ferrous metals are not attracted to a magnet and they also do not rust in the same way when exposed to moisture. Typical Non-ferrous metals include copper, aluminium (coke cans), tin and zinc.

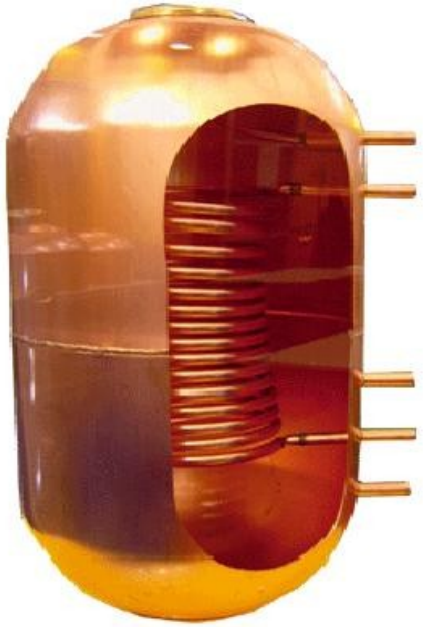
<u>Examples</u>:
1.Aluminium.
2.Copper.
3.Zinc.
4.Tin.
5.Lead.
6.Silver.
7.Gold.
8.Magnesium.

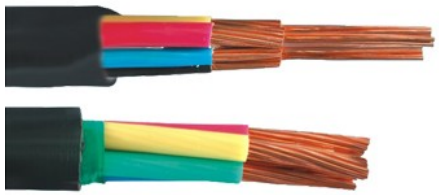
Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Aluminium. **It tends to be light in colour although it can be polished to a mirror like appearance. It is very light in weight.**	**Used for saucepans, cooking foil, window frames, ladders, expensive bicycles.**	**660°C**

Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Copper. **It is a ductile and malleable metal. It is often red / brown in colour. It is a very good conductor of heat and electricity.**	**Used for plumbing, electric components, cookware and roof coverings.**	**1084°C**





Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Zinc. **It is very resistant to corrosion from moisture. However zinc is a very weak metal and is used mainly for coating steel.**	**Used as a coating on screws, steel buckets etc It is also used to galvanize steel.**	**419°C**

Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Tin. **It is a very ductile and very malleable metal. It is resistant to corrosion from moisture. It is bright silver in appearance. Tinplate is steel with a tin coating.**	**Used as a coating on food cans, beer cans. Used as whistles, tin foil and soldering.**	**231°C**

Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Lead. It is a soft, malleable metal. It is also counted as one of the heavy metals. Lead has a bluish-white color after being freshly cut, but it soon tarnishes to a dull grayish color when exposed to air.	Used for roof flashing. Also used for batteries and for X-ray protection. Lead is used for its weight in many ways.	327°C

Classwork /Homework.

(a) Name the non-ferrous metal used to make cooking pots.

(b) Name the metal used for plumbing.

(c) What metal is used to galvanize steel.

(d) A heavy metal used in batteries.

(e) What is tinplate.

Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Silver. **A soft, white, lustrous transition metal, it has the highest electrical conductivity of any element and the highest thermal conductivity of any metal. The metal occurs naturally in its pure, free form.**	**Used for jewelry and high quality cutlery. Also used for currency coins and sports trophies. Used in mirrors as a reflective metal. _**	**961°C**

Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Gold. **Gold is a dense, soft, shiny, malleable and ductile metal. Pure gold has a bright yellow color and luster traditionally considered attractive, which it maintains without oxidizing in air or water. Gold resists attacks by individual acids It won't tarnish, discolor, crumble, or be affected by most solvents.**	**Used mainly for jewelry. Also used in computers as a conductor. Used for its reflective powers to protect satellites.**	**1337°C**

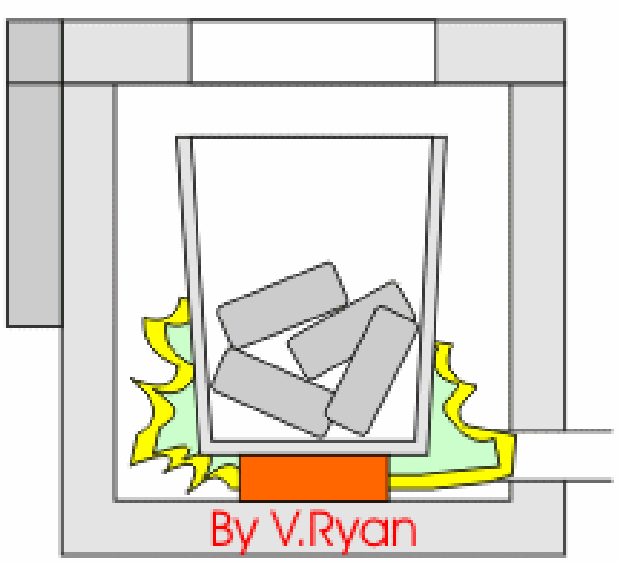
Non – Ferrous Metal.

Metal Type.	Metal Uses.	Melting Point.
Magnesium. **Magnesium is a fairly strong, silvery-white, light-weight metal (one third lighter than aluminum) that slightly tarnishes when exposed to air. In a powder, this metal heats and ignites when exposed to moisture and burns with a white flame.**	**Magnesium is used in pyrotechnic (i.e. fireworks). It is alloyed with other metals to make them lighter and more easily welded.**	**648°C**

Non – Ferrous Metal Alloys.

<u>Non-Ferrous Metal Alloys:</u>
Non-ferrous metal alloys are metals that are a mixture of two or more metals. The main ones in everyday use are,

Brass.
Bronze.
Solder.



Heating metals in a furnace to form an alloy.

Non – Ferrous Metal Alloys.

Metal Type.

Brass.

Brass is a mixture of copper and zinc. Copper is the main component, and brass is usually classified as a copper alloy. The color of brass varies from a dark reddish brown to a light silvery yellow. Brass is stronger and harder than copper, but not as strong or hard as steel. It is easy to form into various shapes, a good conductor of heat, and generally resistant to corrosion from salt water.

Metal Uses.

Brass is used to make water fittings, screws, radiators, musical instruments, and cartridge casings for firearms.

Melting Point.

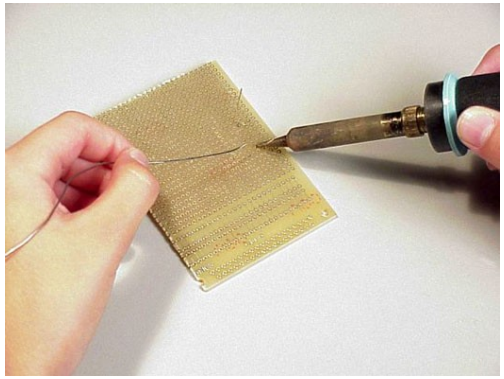
940°C

Non – Ferrous Metal Alloys.

Metal Type.	Metal Uses.	Melting Point.
Bronze. **Bronze is a metal alloy consisting primarily of copper, usually with tin as the main additive. It is a hard and brittle metal. It has a very high resistance to corrosion.**	**Used for ship propellers and underwater fittings. Also used for statues and medals.** -	**950°C**

Non – Ferrous Metal Alloys.

Metal Type.	Metal Uses.	Melting Point.
Solder. **Solder is a fusible metal alloy used to join together metal work pieces and having a melting point below that of the work pieces. It is an alloy of Lead and Tin.**	**Solder is used for electronics, plumbing, jewelry making and repair processes where metal parts cannot be effectively or safely welded.**	200°C



Classwork /Homework.

(a) List the two metals used to make each of the following alloys:

Brass;
Solder;
Steel.

(b) Suggest one application for each of the alloys listed.

(c)Identify the alloy used to manufacture each of the objects shown.

(d) Redraw the given table into your answer book. Complete the table by naming the alloys and listing one important property of each.

Composition.	Alloy.	Property.
Copper + Zinc		
Iron + Carbon		
Lead + Tin		

Metal pieces after mining and separation from their ores.
(Note: Carbon and Phosphorous are non metals, while Silicon is a semi-metal)

Metal Shapes.

Metal can be provided in various shapes and sizes. Some examples of these are shown below.

Round Solid.

Square Solid.

Hexagonal Solid.

Angle Iron Solid.

Round Hollow. (Tube)

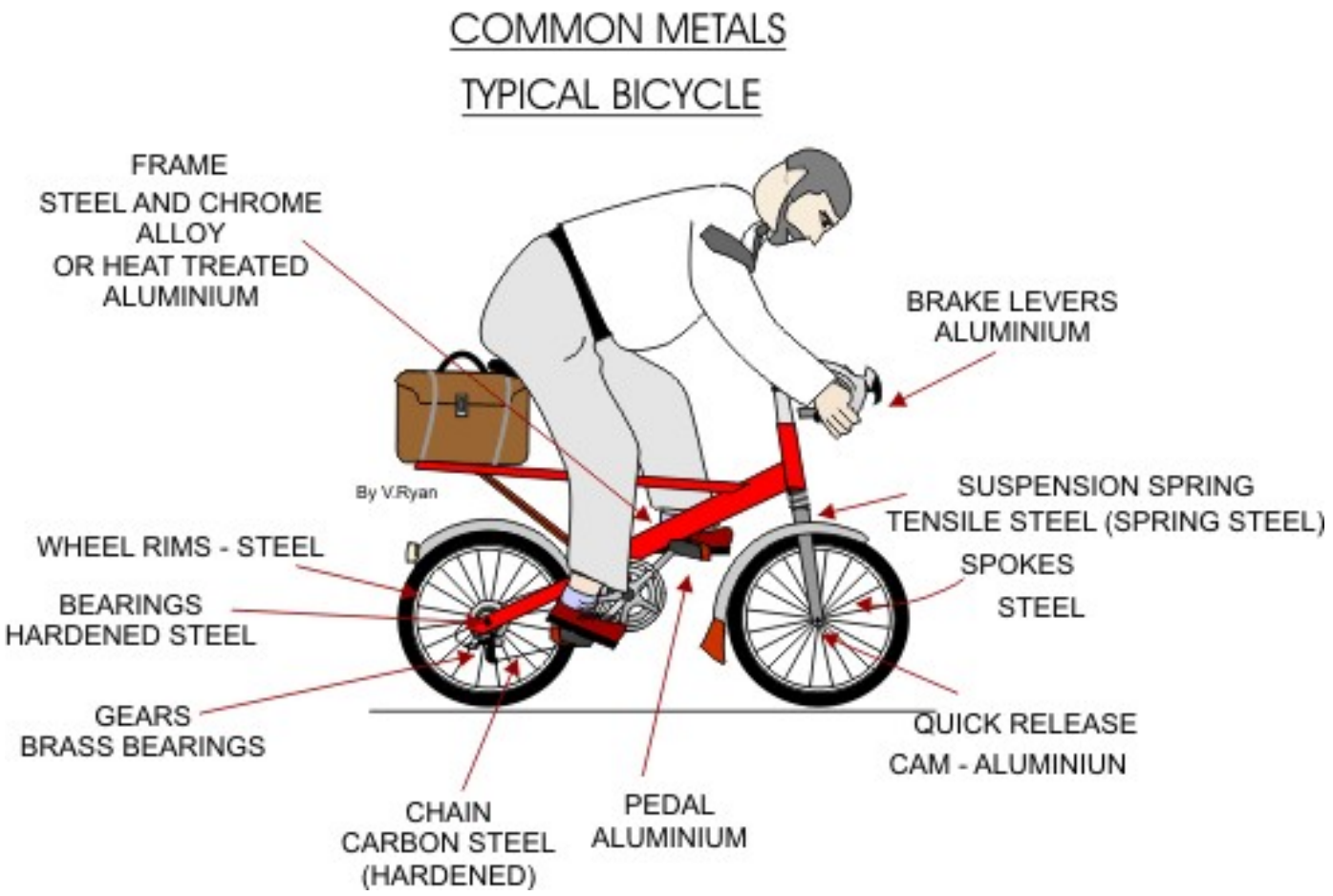
Square Hollow. (Box Iron)

Hexagonal Hollow.

Angle Iron Hollow.

Metals in Everyday Use.

Below is a list of metals that would be used in the manufacturing of a bicycle.



Revision Work/Metals.