**Metals**

**Types, Properties, Uses**

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\*Metals are usually shiny solid materials.

\*Metals conduct heat and electricity.

\*Metals come from ores that are mined from the earth.

\*Most metals are hard and solid at room temperature (except for

mercury).

I. The Importance of Metals

A. Commercial use

1. Buildings, cars, trucks, tunnels, bridges, and etc.

B. Military use

1. Submarines, tanks, ships, aircraft, munitions, and etc.

C. Appliance use

1. Stoves, washing machines, toasters, power tools, farm

machinery, hand tools, and etc.

D. Precious Metal use

1. Coins, jewelry, tableware, cutlery, art metal.

II. Properties of Metals

\*Different characteristics in metals are called properties

A. Chemical properties

1. Reactions with other metals in the solid form

2. Reactions with nonmetal elements such as gases and metalloids.

3. Corrosion resistance is the ability for a metal not to chemically

combine with oxygen. (rust on steel, green coating on copper, and

etc.)

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II. Properties of Metals cont.

B. Physical Properties

1. Characteristics of metal when they are not being acted

upon by an outside force (observable and measurable).

2. Color, density, weight, electrical and thermal conductivity.

3. Conductivity refers to how well or not a metal can

transmit electrons and heat.

C. Mechanical Properties

1. Characteristics of metals when outside forces are applied.

a. hardness-resistance to penetration by other metals

1. can be increased by cold working

2. can be increased by heating methods

b. hardenability-the ability for a metal to become

uniformly hard

c. brittleness-how easily a metal can brake with little or

no bending

d. ductility-property of a metal to be bent, rolled, or

changed without breaking

e. malleability-property that allows a metal to be

hammered or impacted without breaking.

f. toughness-ability of a metal to withstand sudden

shock or repeated use without braking, fracturing or

wearing out. Toughness is more important than

hardness for most applications.

g. tempering-a heating process that reduces hardness

minimally and increases toughness.

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C. Mechanical Properties cont.

h. machineability-refers to how easily a metal can be

cut with conventional machines and tools.

i. fusibility-ability of a metal to join with other metals

in the molten state.

j. weldability-how easily metals can be welded

k. elasticity-ability of a metal to go back to its original

size after being stretched

1. elastic limit is the critical point that a metal

reaches before failing.

l. fatigue-the characteristic of the metal to break when

subjected to repeated loads.

m. strength-resistance of the metal to deformation

1. tensile strength-pulling apart

2. compressive strength-squeezing together

3. shear strength-cutting or slicing forces

4. torsional strength-resistance to twisting forces

III. Classifications of Metals

\*Metals are classified as either pure metal or as alloys

A. Pure Metals

1. Single pure element

2. Earth is made up of at least 100 elements

3. Pure metals are generally soft and low in many strengths

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B. Ferrous and Nonferrous

1. Ferrous metals contain the base element iron in some form or

quantity.

2. Nonferrous metals contain no iron (copper, aluminum, lead, tin,

zinc, and all other metals and alloys).

C. Alloys

1. Mixture of one or more pure metals.

2. Done to increase a desired property or strength.

3. Alloys are generally named after their primary base metal element.

4. Examples of common alloys

a. steel- carbon and iron

b. stainless steel- iron, nickel, carbon, and chromium.

c. brass-copper and zinc

IV. Selection of Metals

\*Metals are selected for their properties to do a certain task.

\*Aluminum is used for lightweight applications (aircraft, boats,

and lawn chairs).

\*Steels and tool steels are used for saw blades, drill bits, and cutters.

\*20,000 different types of alloys now available.

\*350 different types of aluminum alloys.

\*300 different types of copper alloys

\*700 different types of tool steels and specialty steels.

\*More than 100 different types of alloy metals on most automobiles.

\*Some alloys are almost as hard as diamonds.

\*Metallurgist are scientists that work with the periodic table to combine

base elements into new types of alloys.

f:metalsnotes