

A. Mira university

Department of Technology

Teacher: Yasmine TETAH

Iron & Steel Basics

Introduction :

Two of the most essential materials that have shaped human history and continue to play a pivotal role in our modern world. "Iron and steel" are not just ordinary metals; they are the backbone of industries, infrastructure, and innovation.

Iron:

Iron is a chemical element with the symbol Fe (from the Latin "ferrum").

It is one of the most abundant elements on Earth and is found in various forms, including ores like hematite and magnetite.

Iron has been used by humans for thousands of years. It's malleable and can be shaped into various forms when heated.

Steel:

Steel is an alloy of iron and carbon, with small amounts of other elements like manganese, chromium, and nickel.

The carbon content in steel typically ranges from 0.2% to 2.1%. Higher carbon content makes the steel harder but more brittle.

Steel is known for its strength, durability, and versatility. It is used in countless applications, from construction to manufacturing to transportation.

Production of Steel:

The most common method of producing steel is the Blast Furnace Process:

Iron ore is first smelted in a blast furnace to produce pig iron.

Pig iron is then refined into steel through various processes, including the Basic Oxygen Process and the Electric Arc Furnace Process.

Types of Steel:

There are many types of steel, each with different properties. Some common types include:

Carbon Steel: Contains primarily iron and carbon, used in construction and manufacturing.

Stainless Steel: Contains chromium for corrosion resistance, used in kitchen utensils, medical instruments, and more.

Alloy Steel: Contains various alloying elements for specific properties, such as strength and heat resistance.

Applications:

Steel is used in a wide range of applications, including:

- Building and construction (structural steel beams and reinforcing bars).
- Transportation (cars, trains, ships).
- Machinery and equipment.
- Cutlery and kitchen appliances.
- Oil and gas pipelines.
- Aerospace (aircraft and spacecraft components).

Environmental Impact:

Steel production can have a significant environmental impact due to the energy required and CO₂ emissions. Efforts are being made to develop more sustainable steelmaking processes, like using recycled steel and cleaner technologies.

Recycling:

Steel is one of the most recycled materials in the world. Recycling steel saves energy and resources and reduces waste.

Remember that iron and steel are fundamental materials in our daily lives, and their properties can be tailored for specific applications through alloying and processing techniques.

The difference between Iron and Steel:

Iron and steel are closely related materials, but they have distinct differences in terms of composition and properties. Here's a brief illustration of their differences with examples:

1. Composition:

Iron is a chemical element with the symbol Fe and atomic number 26. It is a pure metal and the main component of steel.

Steel is an alloy made by adding carbon (and often other elements) to iron. The carbon content in steel is typically less than 2%.

2. Strength and Hardness:

Iron, in its pure form, is relatively soft and not very strong.

Steel is much stronger and harder than pure iron due to the carbon content. For example, stainless steel is known for its strength and corrosion resistance, making it suitable for cutlery and cookware.

3. Versatility:

Iron is primarily used in its pure form for wrought iron products like gates, railings, and decorative items.

Steel is highly versatile and used in a wide range of applications, including construction (rebar and structural beams), automotive parts, machinery, tools, and more.

4. Rust Resistance:

Iron is prone to rusting when exposed to moisture and oxygen.

Steel can be made more rust-resistant through alloying, as in the case of stainless steel, which contains chromium. This makes it suitable for applications where corrosion resistance is essential, such as in kitchen appliances or medical instruments.

Examples:

An example of pure iron is wrought iron used in decorative gates and fences.

Steel examples include carbon steel, used in structural beams for buildings, and stainless steel, used in kitchen utensils like knives and cookware.

In summary, while both iron and steel have their uses, steel is a more versatile and widely used material due to its added strength and various alloys that can provide desired properties for specific applications.

A. Mira university

Department of Technology

Teacher: Yasmine TETAH

Natural resources

Introduction :

Natural resources are elements or materials that occur in the natural environment and are valuable for human use and consumption. These resources can be categorized into renewable resources (such as sunlight, wind, and forests) and non-renewable resources (like fossil fuels, minerals, and natural gas). Natural resources play a crucial role in supporting human life, providing energy, and serving as raw materials for various industries. Sustainable management of these resources is essential to ensure their availability for future generations.

Renewable Resources: These are resources that can be naturally replenished, such as sunlight, wind, water, and forests. They are considered sustainable because they can be used without depleting them entirely.

Non-Renewable Resources: These are finite resources that cannot be easily replaced, such as fossil fuels (coal, oil, natural gas), minerals (like iron, copper, and gold), and nuclear fuels (uranium). They are finite and take millions of years to form.

Inexhaustible Resources: These are resources that are essentially unlimited in supply, such as solar energy, geothermal energy, and wind energy. While they're technically finite, they are so abundant that they are often considered inexhaustible on human timescales.

Fossil Fuels: fuels formed by natural processes like decomposition of death plants and animals like:
Petroleum - Coal - Natural gas.

Importance of Natural Resources:

Economic Value: Natural resources are vital for economic development. They are used in various industries, from agriculture to manufacturing, and contribute significantly to a nation's GDP.

Environmental Balance: Ecosystems rely on natural resources for their health and stability. Forests, for example, help regulate the climate and provide habitat for many species.

Human Survival: Clean water, clean air, and fertile soil are all natural resources necessary for human survival. Without these, our well-being is compromised.

Challenges:

Overexploitation: Human activities can lead to overuse and depletion of natural resources, especially non-renewable ones. This can have serious environmental and economic consequences.

Pollution: The extraction and use of natural resources can result in pollution, which harms ecosystems and human health. For example, burning fossil fuels releases greenhouse gases that contribute to climate change.

Conservation: Sustainable management and conservation of natural resources are crucial to ensure their availability for future generations. This involves responsible resource extraction and the development of clean and renewable alternatives.

Understanding and managing natural resources is essential for a sustainable and balanced future for both the environment and human society.

A. Mira university

Department of Technology

Teacher: Yasmine TETAH

Condensation is the process where water vapor becomes liquid. It is the reverse of **evaporation**, where liquid water becomes a vapor.

Condensation happens one of two ways: Either the air is cooled to its dew point or it becomes so saturated with water vapor that it can not hold any more water.

Depending on temperature and location, condensation can take place in different forms like dew, frost, fog, mist and clouds.

Dew point:

Dew point is the temperature at which condensation happens. (Dew is simply condensed water in the atmosphere.) Air temperature can reach or fall below the dew point naturally, as they often do at night. That's why lawns, cars and houses are often coated with water droplets in the morning.

Condensation can also produce water droplets on the outside of soda cans or glasses of cold water. When warm air hits the cold surface, it reaches its dew point and condenses. This leaves droplets of water on the glass or can. When a pocket of air becomes full of water vapor, clouds form. The point at which condensation starts can be easily viewed in cumulus clouds, which have flat bottoms. Those flat bottoms are where vapor begins to condense into water droplets.

Saturation :

Clouds are simply masses of water droplets in the atmosphere. Molecules in water vapor are far apart from one another. As more water vapor collects in clouds, they can become saturated with water vapor. Saturated clouds can not hold any more water vapor.

When clouds are saturated with water vapor, the density, or closeness of the molecules increases. The vapor condenses and becomes rain.

Definitions:

- Cumulus : type of large cloud with a flat bottom and fluffy tops.
- Density: number of things of one kind in a given area.
- Evaporation: process by which liquid water becomes water vapor.
- Humid: containing a large amount of water vapor.

- Liquid: state of matter with no fixed shape and molecules that remain loosely bound with each other.
- Molecule: smallest physical unit of a substance, consisting of two or more atoms linked together.
- Process: natural or human action that create and change the Earth's features.
- Vapor: visible liquid suspended in the air, such as fog.

Keep it in your mind:

Evaporation is the process in which a liquid, such as water, changes into a gas or vapor when it gains enough energy. This occurs when the temperature of the liquid rises, and individual molecules in the liquid gain enough kinetic energy to escape from the liquid's surface and become gas molecules. You can observe evaporation in everyday life when water left in an open container slowly disappears, as it's turning into water vapor.

Condensation is the reverse process of evaporation. It's when a gas or vapor, like water vapor, cools down and loses energy, causing the gas molecules to come together and form a liquid. This process is responsible for the formation of clouds in the sky. When warm, moist air rises and cools at higher altitudes, the water vapor within it condenses into tiny water droplets, creating visible clouds.

Both evaporation and condensation are part of the water cycle, which is crucial for the distribution of water on Earth. They play a significant role in weather patterns, and understanding these processes is fundamental to our understanding of Earth's climate and the functioning of ecosystems.