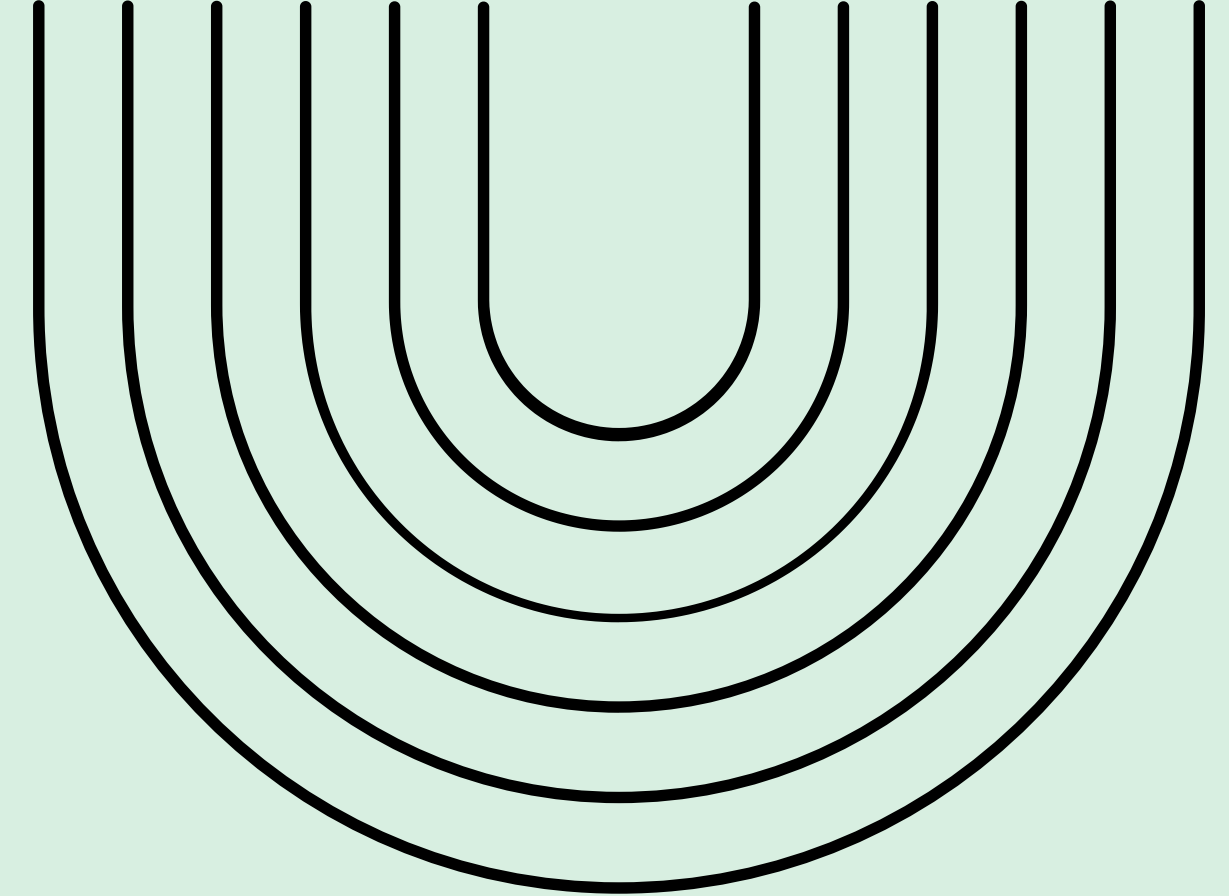




# **NATURAL MATERIAL**

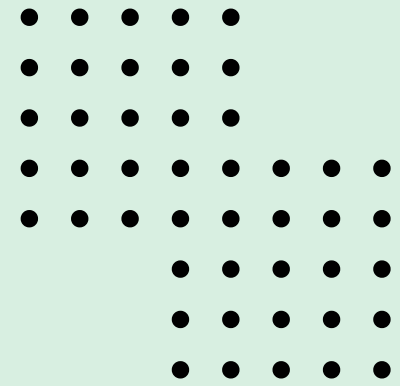
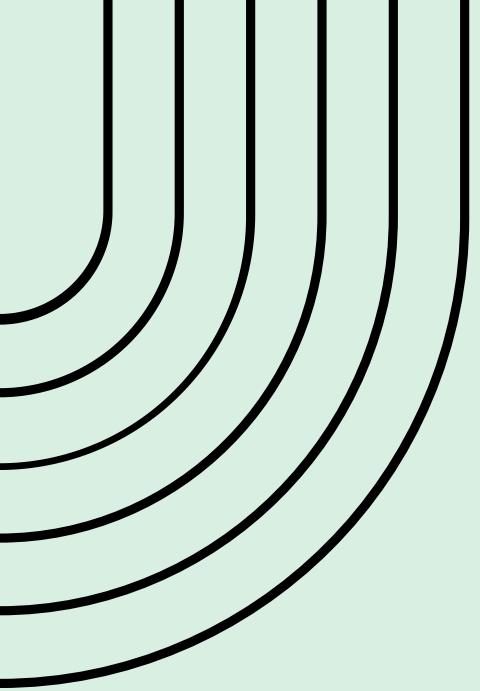


# NATURAL MATERIAL



Natural materials are substances that occur in nature and have not been, or to a minimal part, artificially processed by humans, such as biological structures or minerals. They are often composed of various organic and inorganic components that interact with each other to form complex structures.





# ● ● ● ● ● HOW DID THEY FORM?

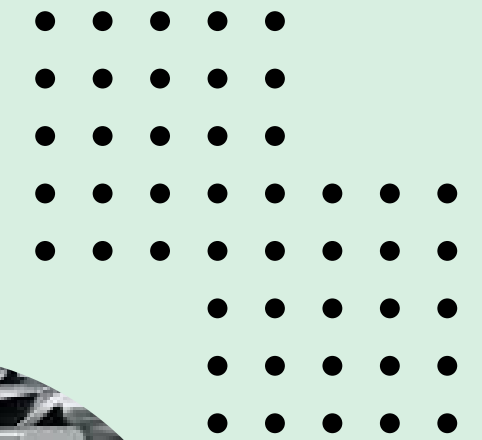
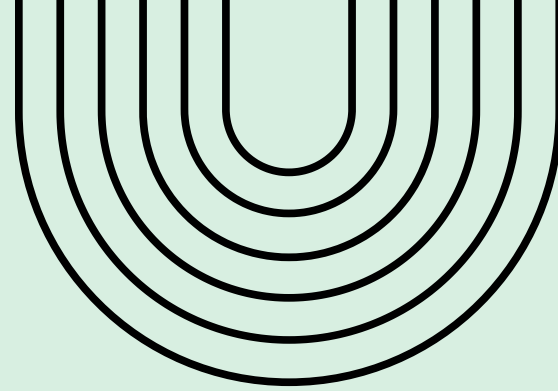
Natural materials form through various geological, biological, and chemical processes over extended periods such as formation of rocks and minerals, fossil fuels from the remains of ancient plants and animals, and bones from the mineralization of collagen.



# PROPERTIES OF A NATURAL MATERIAL

Property Category	Specific Property	Example Material	Application
Mechanical	High Strength-to-Weight Ratio	Wood, Bamboo	Structural components, furniture
Thermal	Excellent Insulating Properties	Wool, Cotton	Clothing, bedding
Optical	Unique Light Transmission	Certain woods, minerals	Optics, decorative items
Electrical	Conductivity/Resistivity	Graphite (from natural sources)	Electronics (depending on type)
Magnetic	Magnetic Properties	Magnetite	Specialized applications

# PROCESSES:



## WOOD

Wood is one of the most widely used natural materials in construction and furniture making. It can be processed using different techniques such as sawing, planing, sanding, and finishing.



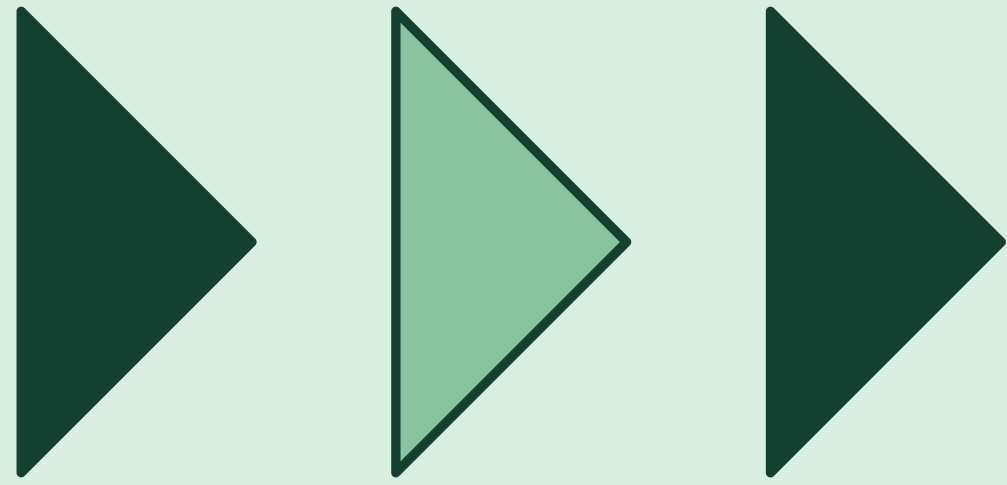
## TEXTILES

Textiles refer to fabrics made from natural fibers like cotton, wool, silk, and linen. They undergo several processes before they become usable textiles.



## METALS

Metals like copper, aluminum, and iron are also commonly used in construction and manufacturing. They undergo various processes like smelting, refining, casting, and machining.



# USES OF NATURAL MATERIALS



**1. Construction:** Wood, stone, and clay are fundamental for building structures.

**2. Textiles and Clothing:** Natural fibers like cotton, wool, and silk, along with leather, are used for clothing and textiles.

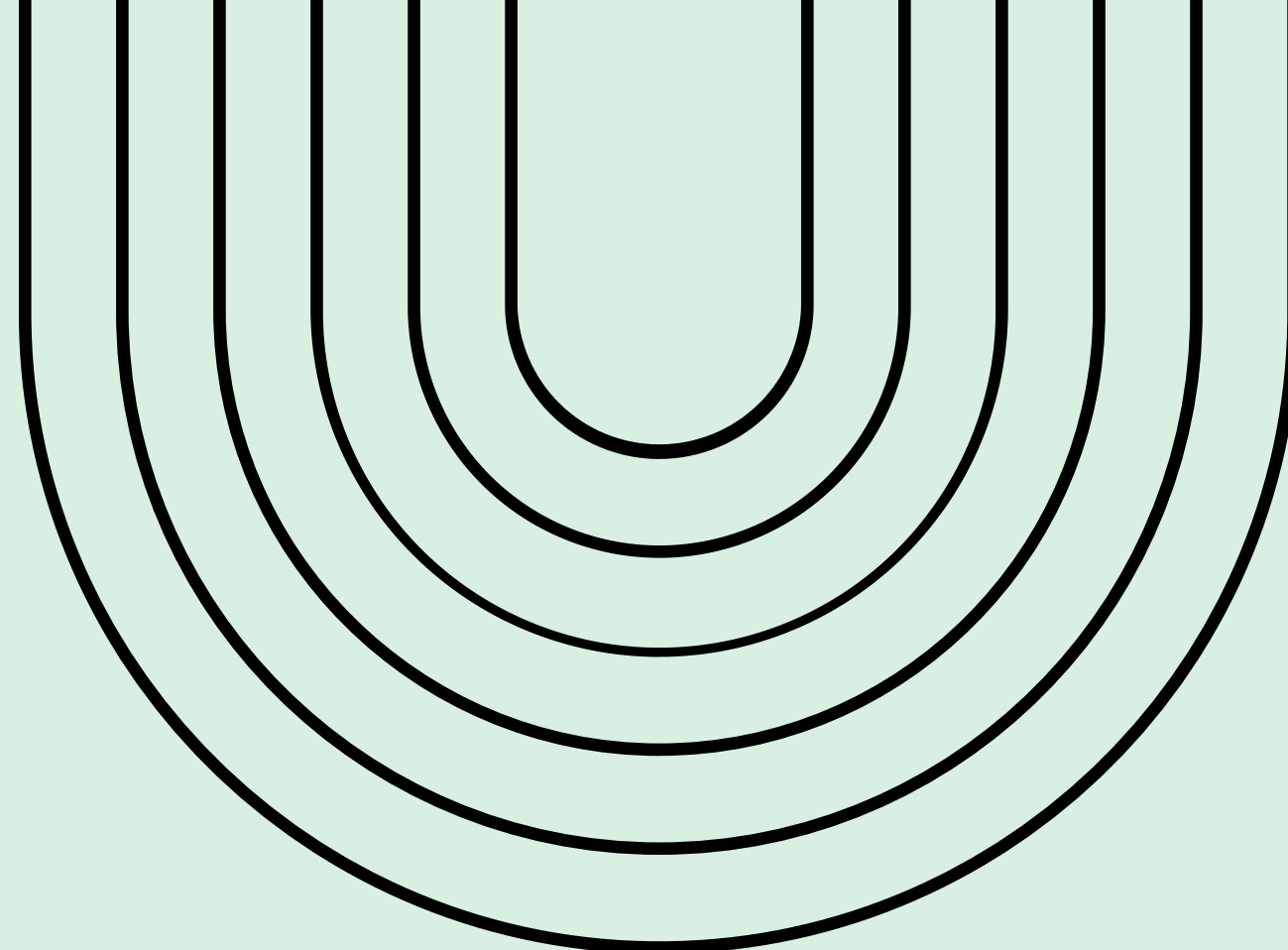
**3. Fuel and Energy:** Wood and biomass provide energy sources.

**4. Food and Medicine:** Plants and animals are crucial for sustenance, and natural substances serve medicinal purposes.

**5. Crafts and Decoration:** Natural materials are used to create decorative items and natural dyes.

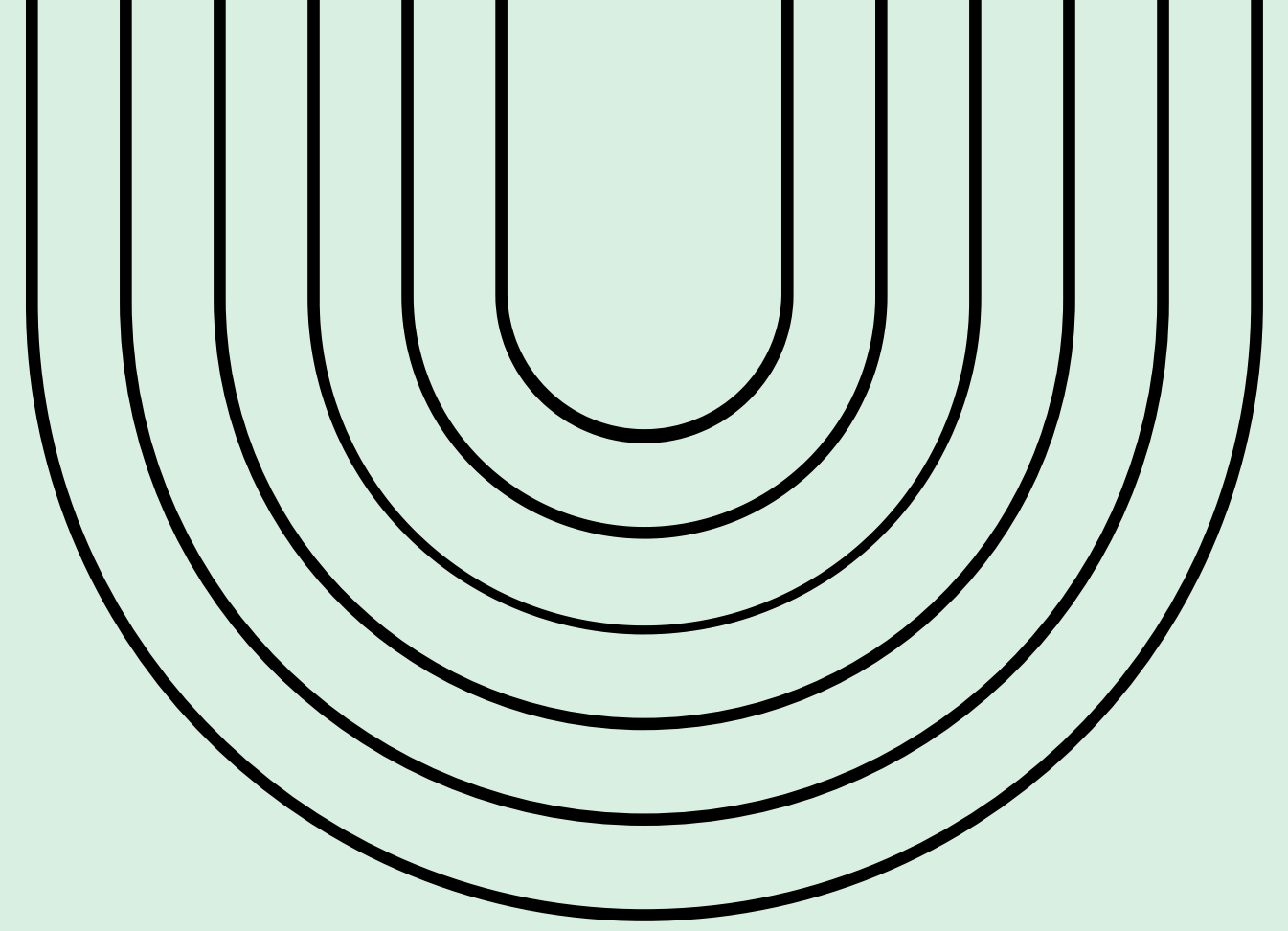


# EXAMPLES OF NATURAL MATERIALS





**WOOD**



# WOOD ✨

Wood is an organic material produced by many trees and is quite variable in its properties. Wood is a natural, organic material, primarily composed of cellulose fibers embedded in a matrix of lignin, which are found in the stems and roots of trees and other plants.



# WOOD ✨



## SOURCE

- gymnosperms
- angiosperms

## PROPERTIES

- Strength
- Durability
- Density
- Moisture Content
- Workability

## PROCESSING

- sawing
- planing
- drilling
- shaping
- sanding
- finishing

## APPLICATIONS

- Fuel
- Construction
- Tool
- Furniture
- Packaging

# WOOD ✨



## ADVANTAGES

- Low-cost and eco-friendly
- Heat insulation and high heating efficiency
- Easy transport due to low density
- High specific strength and stress resistance
- Sound

## DISADVANTAGES

- Burns easily
- Weakens when wet
- Prone to pests, rot, and decay
- Strength varies across species
- Anisotropic properties affect performance

## TYPES OF WOOD

- **Softwood** - Wood from coniferous trees, typically lighter and easier to work with.
- **Hardwood** - Wood from deciduous trees, usually denser and more durable.

**Engineered wood** - Man-made wood products using wood fibers, veneers, or particles bonded together.

# WOOD ✨



## Carbon Content

A global analysis of over 3,600 wood carbon observations found that wood carbon fractions ranged from 18.4% to 75.1%, with the mean carbon fraction for tree species in the USDA Forest Service FIA program being 47.4%, not 50%.

### Softwood

Common name	Carbon content [C·t <sup>-1</sup> ]
Douglas fir	0.5280
Norway spruce	0.4980
Maritime pine	0.5212
Silver fir	0.4750
Scots pine	0.5036
Other conifers	0.5052

### Hardwood

Common name	Carbon content [C·t <sup>-1</sup> ]
Sweet chestnut	0.5010
Hornbeam	0.4899
Ash	0.4918
European beech	0.4709
Sessile oak	0.4970
English oak	0.5016
White oak	0.4948
Other broadleaved	0.4924

Wood density and carbon content per forest tree species.

# WOOD ✨



## Heating Value of Wood

The maximum heating value of one kilogram of oven-dry wood averages about 4,500 kilocalories (with a range of 4,100–6,800 kilocalories).

Wood Group	Heating Value Btu/lb (Dry)	Heating Value MJ/kg (Dry)
Eastern Oaks	9510	22.12
High Density Eastern Hardwoods	9360	21.77
Bigleaf Maple/Oregon Ash	8400	19.54
Medium Density Eastern Hardwoods	8400	19.54
Western Hardwoods	8110	18.86
Red Alder	8000	18.61
Yellow Poplar	9360	21.77
Low Density Eastern Hardwoods	8800	20.47
Southern Yellow Pine	10,380	24.14
Douglas Fir	9200	21.40
Hem-Fir	8500	19.77
Spruce Pine Fir (SPF)	9100	21.17

1 MJ/kg = 429.923 Btu/lb

Estimates of Heating Value of Different Wood Groups (Conway 2010)

# WOOD ✨



## Heating Value of Wood

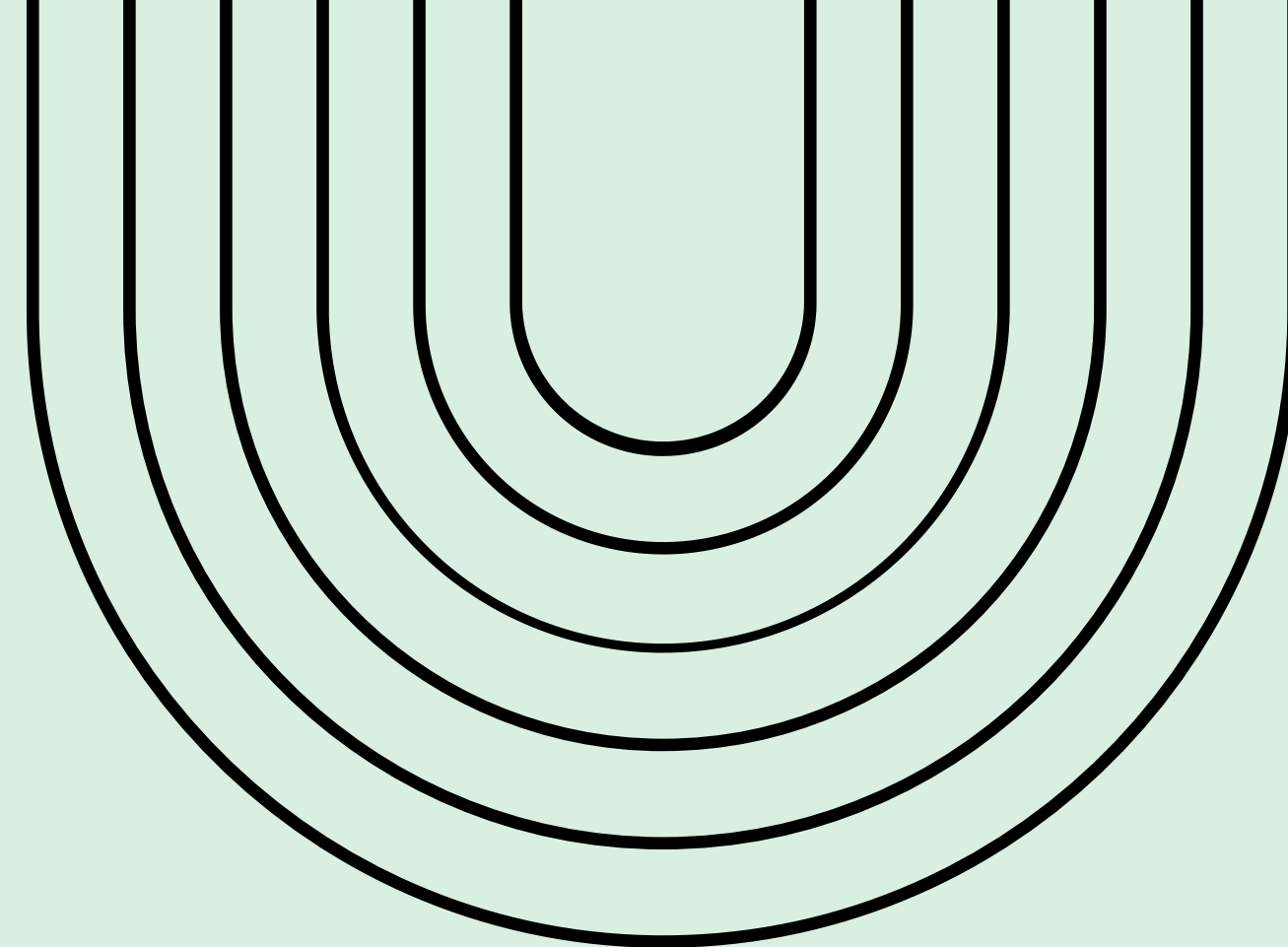
Raw Material	KJ/Kg (KiloJoule/Kg) Lower calorific values	KJ/Kg (KiloJoule/Kg) Higher calorific values
Softwood	17500	21100
Hardwood	18600	20700
Oak	17400	18800
Birch wood	18700	20100
Pine wood	19500	20800
Douglas pine wood	19700	21000
Spruce wood	18500	19800
Cherry wood	17900	19100

Raw Material	KJ/Kg (KiloJoule/Kg) Lower calorific values	KJ/Kg (KiloJoule/Kg) Higher calorific values
Cypress wood	21500	23000
Elm wood	19000	20500
Eucaluptus wood	18300	19600
Maple wood	18700	20000
Larch wood	18700	20100
Poplar wood	19400	20800
Teak wood	18900	20200
Coconut trunk wood	16600	17800
Willow wood	17300	18600

Energy content for various biomass (dry weight basis)

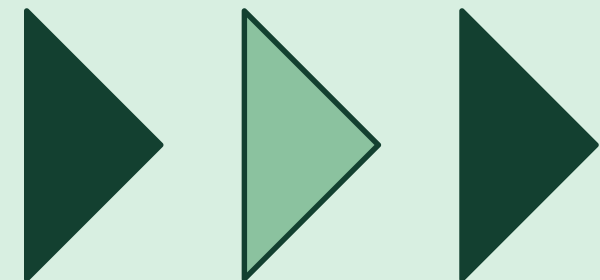
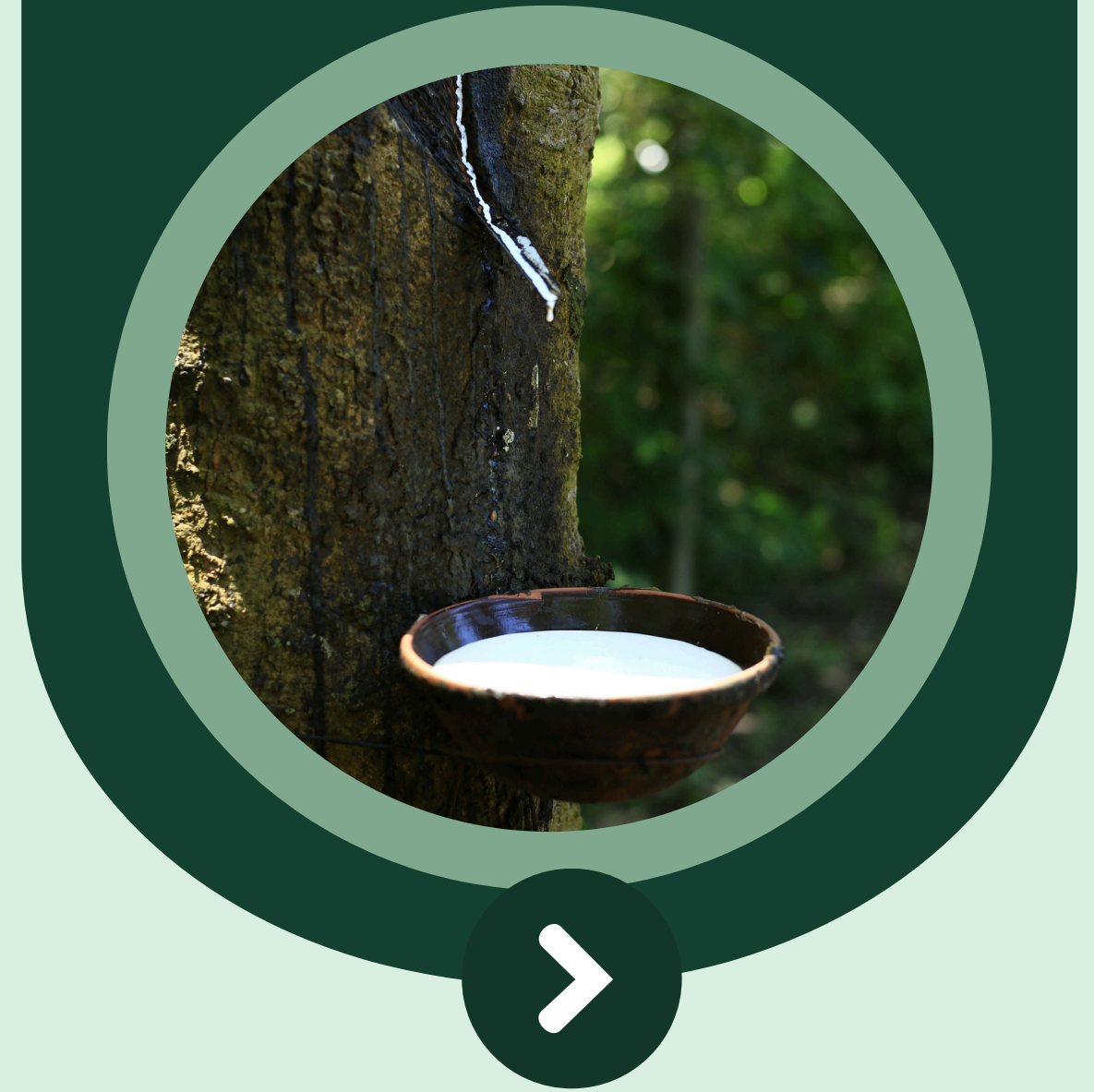


# RUBBER



# RUBBER ✨

Natural rubber is an elastic polymer, specifically a polyisoprene, composed of long chain-like molecules with repeating isoprene subunits. It is known for its elasticity and resilience.



# RUBBER ✨



## **SOURCE**

- Extracted from latex, primarily from the Hevea Brasiliensis tree.

## **PROPERTIES**

- Biodegradable.
- Excellent tensile, elongation, and abrasion resistance.
- Low weight and cost.
- High specific strength and stiffness.

## **PROCESSING**

- Latex is collected from tree bark.
- Ammonia is added to prevent solidification.
- Rubber is extracted via coagulation with acid.
- Rollers remove excess water.

# RUBBER ✨



## APPLICATIONS

- Shock and energy absorption.
- Wire and cable insulation.
- Automotive parts (brake pads, airbags, window seals).
- Steam hoses, mechanical goods, and adhesives.

## ADVANTAGES

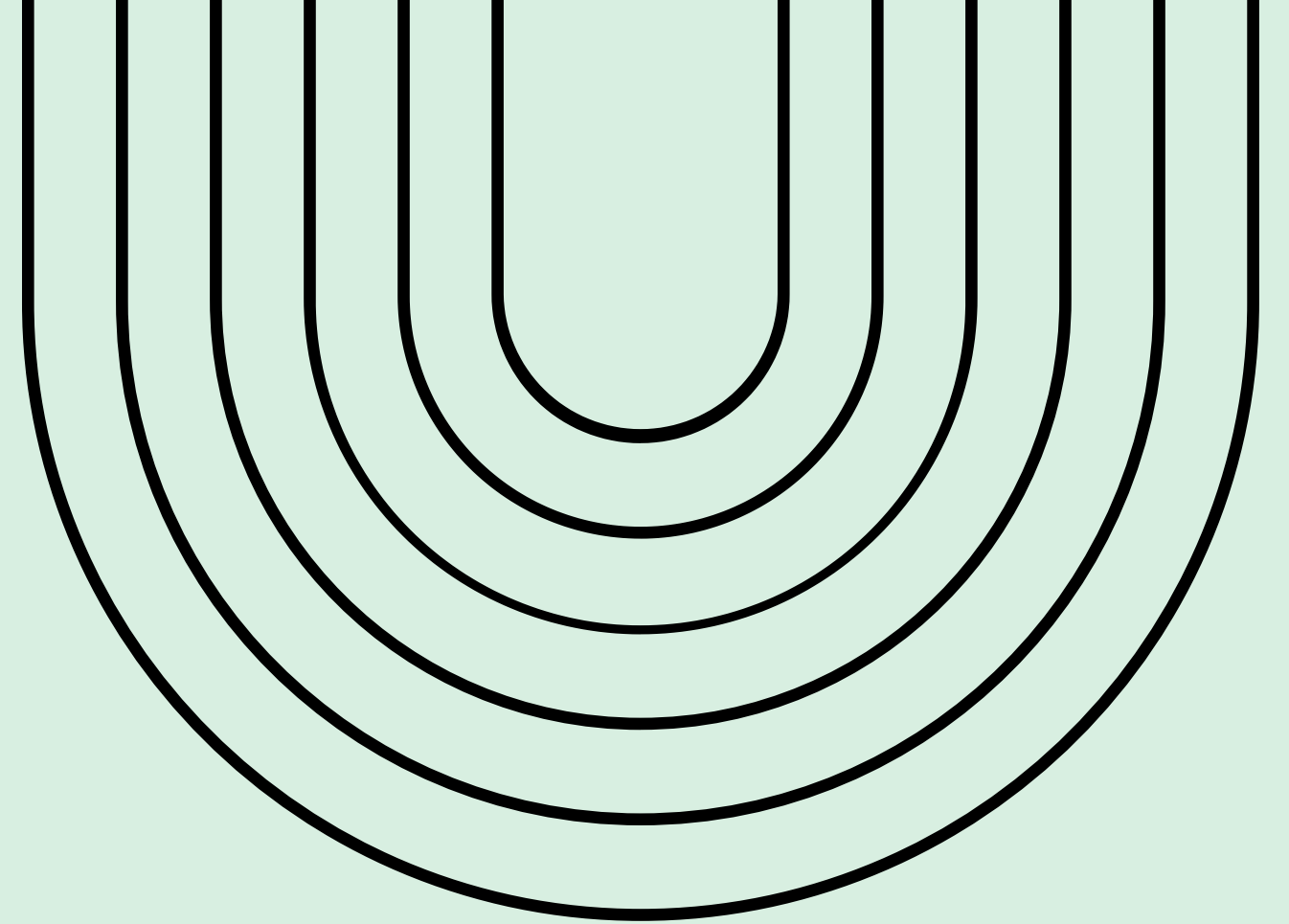
- Water and chemical resistance
- High resilience, tensile strength, and tear resistance.
- Retains shape after deformation.

## DISADVANTAGES

- Degrades with exposure to chemicals, petroleum derivatives, and environmental factors.
- Low heat resistance and physical properties weaken over time.



**OIL**



# OIL ✨

Oil refers to any greasy substance that remains liquid at room temperature and cannot dissolve in water. It encompasses a wide range of natural and synthetic types, serving purposes in cooking, energy, lubrication, and more.



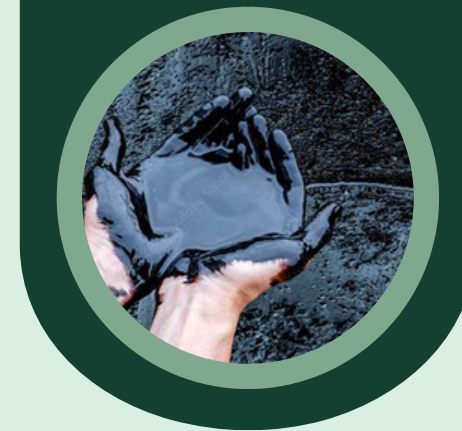
# OIL ✨



## Properties:

- **Chemical composition-** Oil is a mixture of hydrocarbons (compounds of carbon and hydrogen) in varying chain lengths.
- **Versatile States-** Oil can exist as gas, liquid, or semi-solid, depending on refining and usage needs.
- **Mixing Ability-** It blends easily with other substances, allowing for the creation of a variety of products (e.g., lubricants, plastics).
- **Stability-** Oil is stable under normal conditions, making it safe to store and transport.

# TYPES OF OIL ✨



## 1. Petroleum-Based Oil

- A naturally occurring liquid found beneath the Earth's surface

## 2. Edible Oils

- plant-derived oils fit for human consumption

## 3. .Essential Oils

- Concentrated plant extracts obtained through processes like distillation

## 4. Synthetic Oils

- Artificially created oils, often used as lubricants in machinery and vehicles.

## 5. Bio-Oils:

- Renewable oils produced from biological sources such as plants or algae.

# OIL PROCESSES ✨



## 1. Extraction

- Primary Recovery
- Secondary Recovery
- Enhanced Oil Recovery (EOR)

## 2. Treatment and Separation

- Dehydration
- Desalting
- Gas Separation

## 3. Transportation

- transported from extraction sites to refineries

## 4. Blending

- blended to meet market specifications

## 5. Storage and Distribution

- Oil and its refined products are stored in tanks and distributed

## 6. Recycling

- Used oil undergoes reprocessing to be reused in industrial or automotive applications.

# OIL REFINERY



## 1. Distillation

- involves the separation of materials based on differences in their volatility.

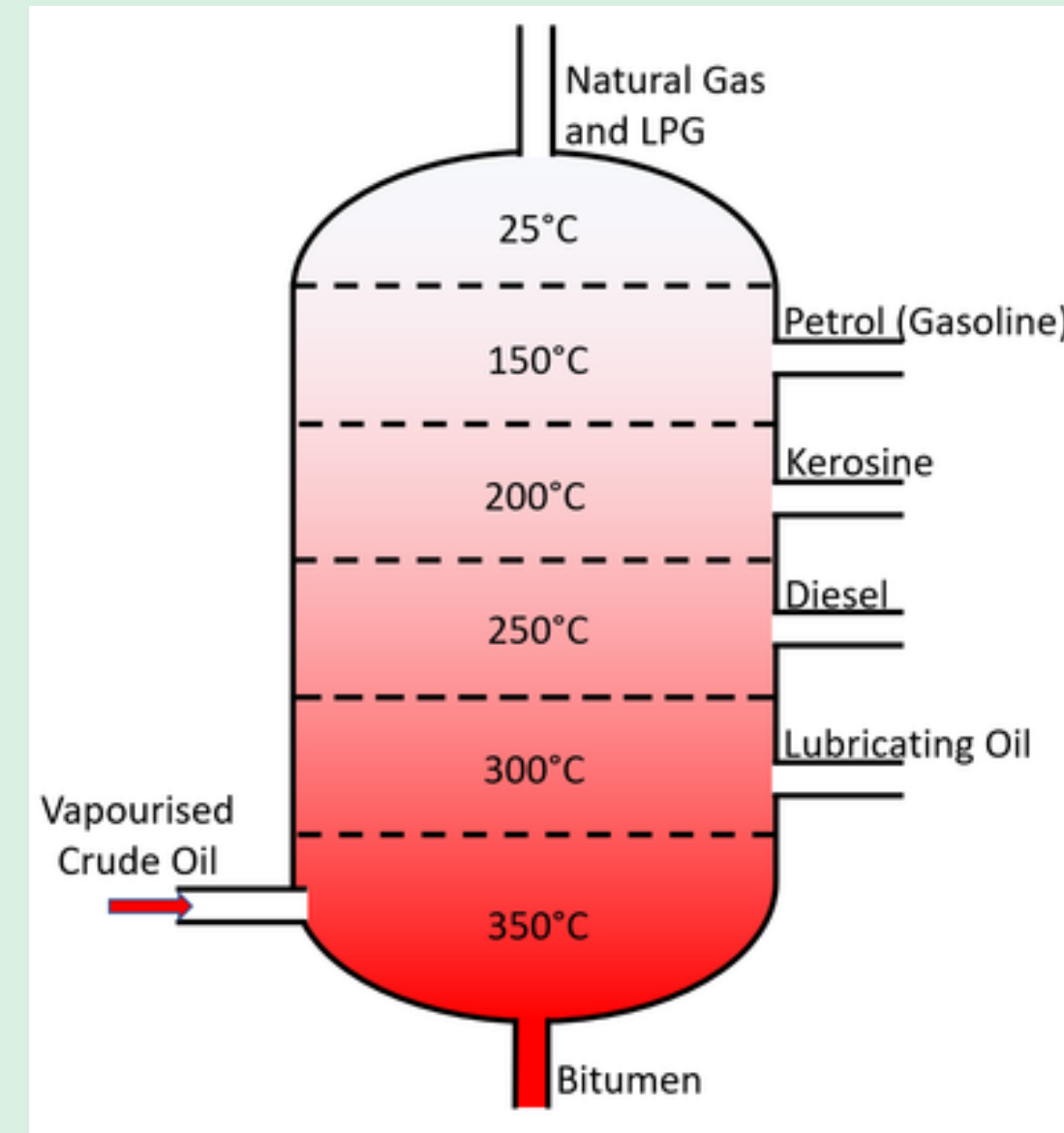
## 2. Cracking

- involves breaking up heavy molecules into lighter (and more valuable) hydrocarbons

## 3. Reforming

- involves changing the chemical nature of hydrocarbons to achieve desired physical properties

under distillation:



## PRODUCTS OF CRUDE OIL:

Substance	Boiling Point Range (°C)
Natural Gas	Below -161°C
Liquefied Petroleum Gas (LPG)	-42°C to -0.5°C
Petrol (Gasoline)	40°C–205°C
Kerosene	150°C–275°C
Diesel	200°C–350°C
Lubricating Oil	300°C–370°C
Heavy Fuel Oil	370°C–600°C
Bitumen	Above 525°C

## APPLICATION:



### 1. Fuel and energy

- Transportation
- Power Generation
- Heating

### 2. Petrochemicals

### 3. Industrial Applications

- Lubricants
- Bitumen/Asphalt
- Industrial Fuel

### 4. Agriculture Products

### 5. Consumer Products

### 6. Energy Sector

# OIL ✨



## Advantages :

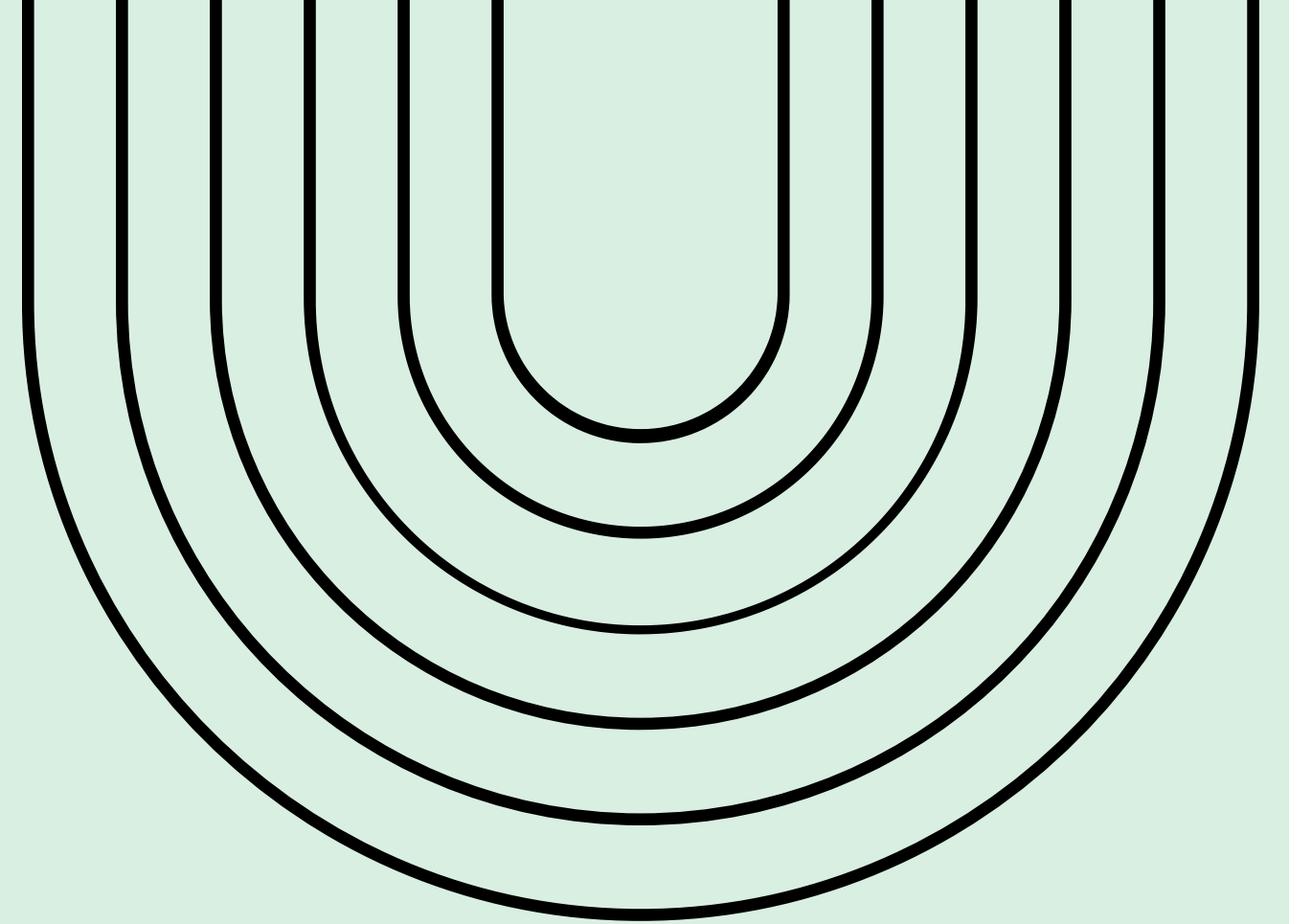
- **High Energy Density-** Petroleum contains a significant amount of energy per unit
- **Versatility** -It can be refined into a wide variety of products.
- **Accessible-** Extensive global infrastructure exists for extraction, refining, transportation, and distribution, making it widely accessible.

## Disadvantages:

- **Environmental Impact-** Combustion of petroleum releases greenhouse gases and pollutants.
- **Non-Renewable Resource -** Petroleum reserves are finite and take millions of years to form.
- **Dependence and Geopolitics-** Many countries depend heavily on petroleum imports



# COAL



# COAL ✨

a natural material formed only from the fossilized remains of plants that underwent decomposition, compression, and heat over millions of years, serving as a significant source of energy due to its carbon-rich composition.



# PROPERTIES OF COAL ✨



- **High Carbon Content:** Coal has a high carbon content, which determines its energy yield during combustion as carbon reacts with oxygen to release heat.
- **Abundance and Availability:** Coal is widely available, with many countries having vast reserves, making it a convenient and reliable energy source.
- **Efficient Combustion:** Coal burns easily at high temperatures, providing a steady supply of heat, ideal for power generation in boilers that produce steam to drive turbines.
- **High Energy Density:** Bituminous and anthracite coals have high energy density, generating significant energy from small quantities, making them efficient for large-scale power production.

## **APPLICATIONS:**

Coal is used in various ways, including:

- **Steel Production**
- **Residential Heating**
- **Chemical Production**
- **Air Purification**
- **Water Filtration**
- **Electricity Generation**

## **HOW IT IS BEING PROCESSED:**



- 1. Mining**
- 2. Crushing and Screening**
- 3. Washing**
- 4. Drying**
- 5. Preparation**
- 6. Conversion**

# TYPES OF COAL ✨



## Anthracite

- Carbon Content: 86%-97%
- Known as "hard coal," it's the most carbon-rich and energy-efficient.

## Bituminous

- Carbon Content: 45%-86%
- Widely used for electricity generation and industrial processes.

## Subbituminous

- Carbon Content: 35%-45%
- Lower carbon and energy content than bituminous.

## Lignite

- Carbon Content: 25%-35%
- Lowest carbon content and energy density, often called "brown coal."

# TYPES OF COAL ✨



## Anthracite

- Carbon Content: 86%-97%
- Known as "hard coal," it's the most carbon-rich and energy-efficient.



## Uses

### Heating:

Anthracite is primarily used for space heating due to its clean-burning properties and high heating value.

### Industrial Applications:

It's also used in various industrial processes, including electricity generation, metal production, and water filtration.

## FYI

It has the highest carbon content, the fewest impurities, and the highest energy density of all types of coal and is the highest ranking of coals.

# TYPES OF COAL ✨



## Bituminous

- Carbon Content: 45%-86%
- Widely used for electricity generation and industrial processes.



## Uses

**Electricity Generation :**  
Bituminous coal is a major fuel source for power plants, used to generate electricity.

**Steel Production:**  
It's used in the production of coke, which is a key ingredient in steelmaking.

**Other Industrial Applications:**  
Bituminous coal can also be used in cement manufacture, alumina refining, and paper manufacture.

## FYI

The combustion rates of three different sized fractions of char from a swelling bituminous coal have been measured in the temperature range 800 to 1700 K

# TYPES OF COAL ✨



## Subbituminous

- Carbon Content: 35%-45%
- Lower carbon and energy content than bituminous.



## Uses

Subbituminous coal is primarily used for steam-electric power generation.

## FYI

The heating values of subbituminous coals range from 8,300 to 11,500 Btu/lb on a wet, mineral-matter-free basis, and from 9,420 to 10,130 Btu/lb on an as-mined basis.

# TYPES OF COAL ✨



## Lignite

- Carbon Content: 25%-35%
- Lowest carbon content and energy density, often called "brown coal."



## Uses

### Electricity Generation:

Lignite is primarily used for electricity generation in power plants.

### Other Uses:

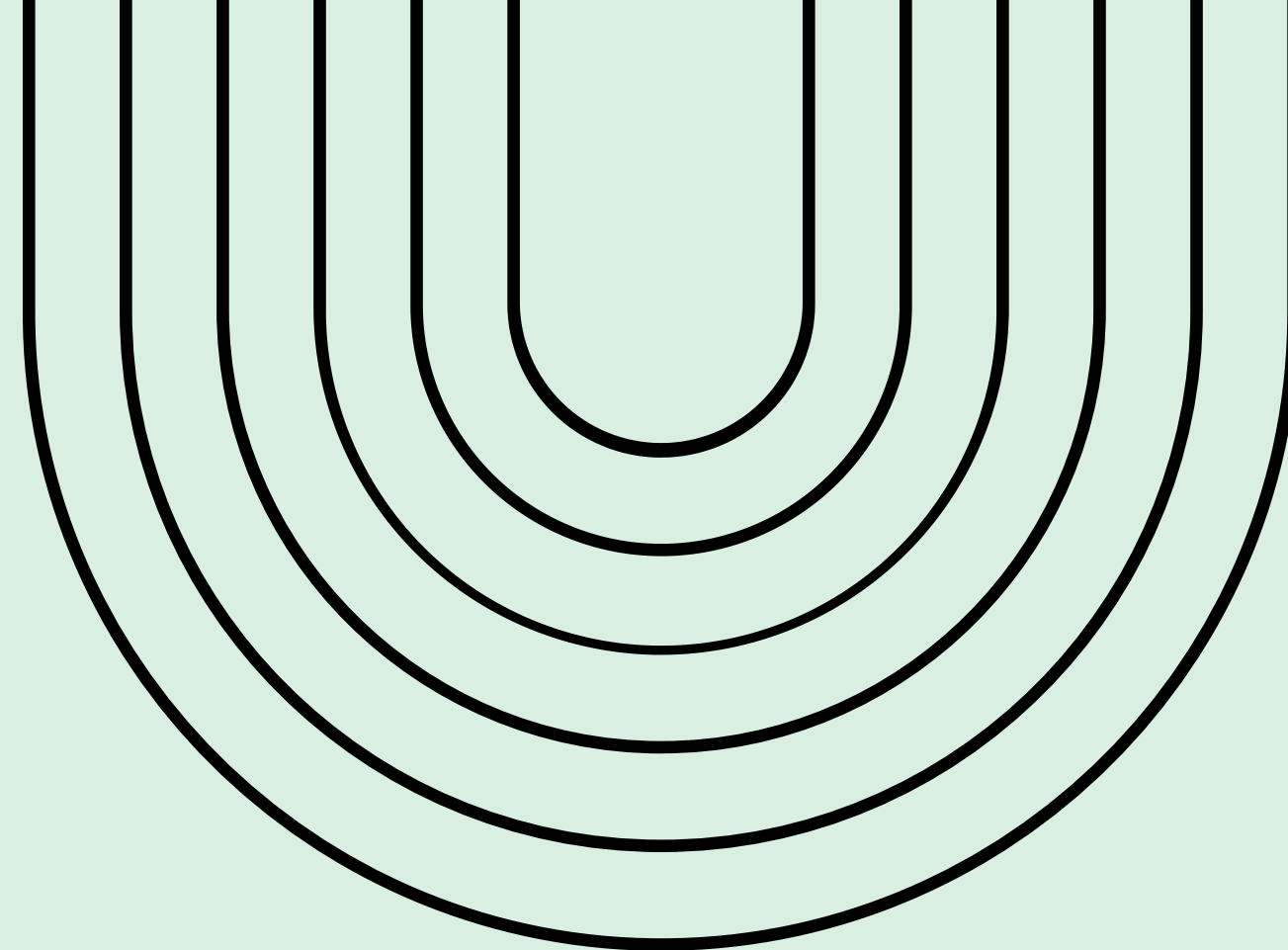
While less common, lignite can also be used in fertilizer production and as a raw material for synthetic natural gas.

## FYI

Lignite is the youngest of the coal types, meaning it hasn't been subjected to the extreme heat and pressure that transforms other coal types.

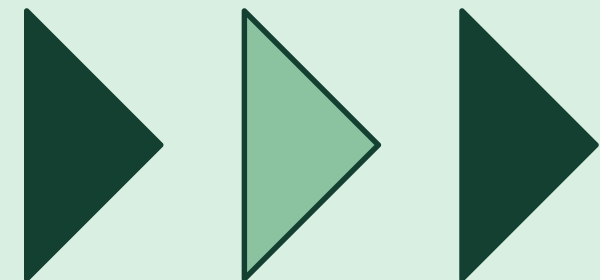
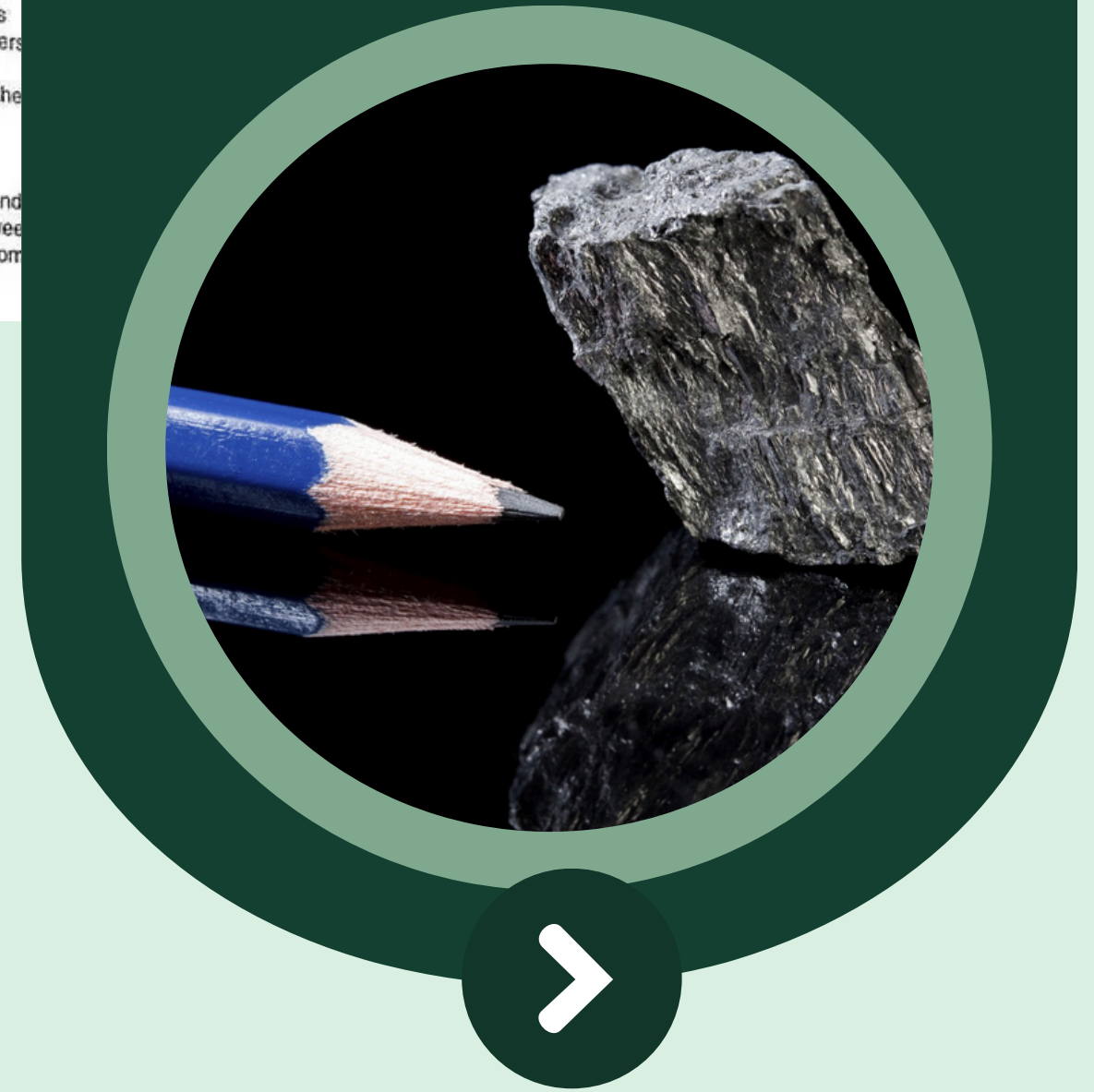
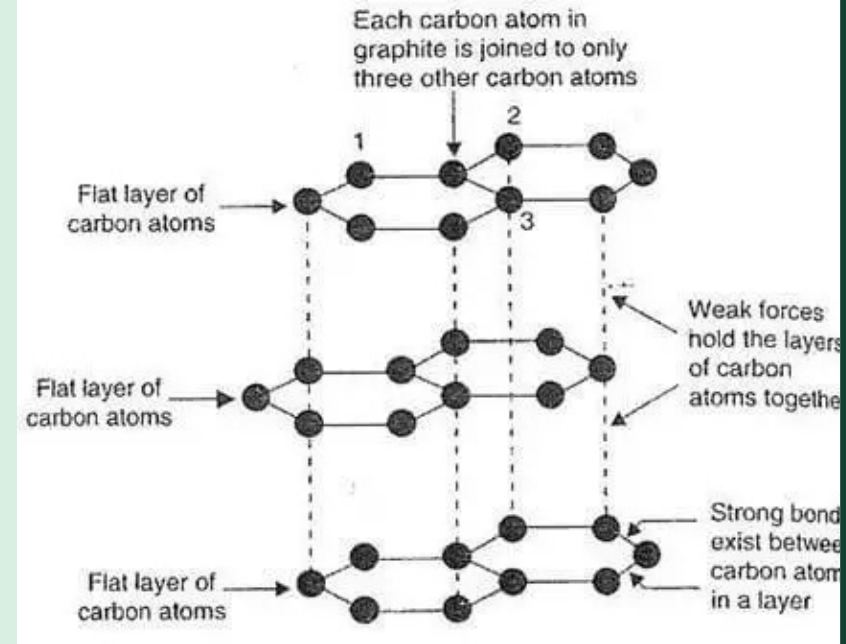


# GRAPHITE



# GRAPHITE ✨

Graphite is a naturally occurring form of crystalline carbon, characterized by its slippery texture, electrical conductivity, and use in various applications such as lubricants, pencils, and as a component in batteries and electrical devices.



# GRAPHITE ✨



## Applications:

- works as electrodes in batteries and solar panels.
- used as a lubricant to reduce friction in machines.
- used in furnace linings, molds for steelmaking, and as electrodes in arc furnaces.
- main material in pencil cores for writing.
- helps control reactions in nuclear reactors and forms advanced materials like graphene and carbon fibers

## Classifications:

1. Natural graphite- Found in nature and mined for industrial use.
  - Crystalline Flake Graphite
  - Amorphous Graphite
  - Vein Graphite
2. Synthetic graphite- Manufactured from carbon materials like petroleum coke under high temperatures.

# GRAPHITE ✨



How it is being processed:

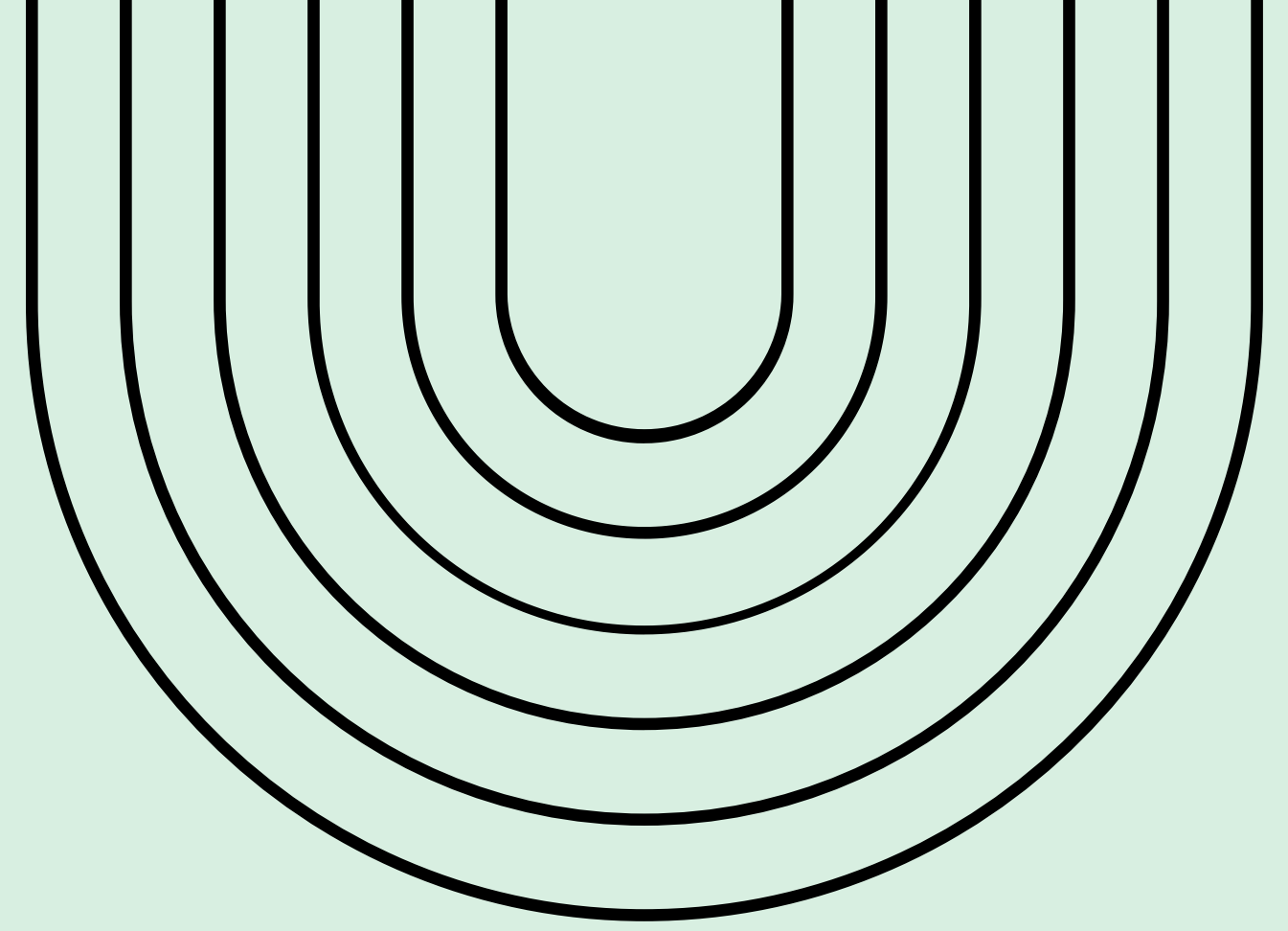
- 1. Mining**
- 2. Crushing and Grinding**
- 3. Screening**
- 4. Purification**
- 5. Shaping**

# COMPARISON BETWEEN COAL AND GRAPHITE

	Coal	Graphite
<b>Structure and Composition</b>	lacks a defined atomic structure with a porous, uneven pattern formed during pyrolysis	has a crystalline lattice with hexagonal layers that slide easily due to weak interlayer forces
<b>Mechanical Properties</b>	Brittle, porous, and weak, which limits its structural applications.	Soft, slippery, and has good lubricating properties, making it useful in high-temperature and friction-reducing applications.
<b>Thermal and Electrical Conductivity</b>	Poor conductor of heat and electricity.	Excellent thermal and electrical conductor due to its layered structure.
<b>Applications</b>	Mainly used as a fuel and not for structural or functional engineering applications.	Used in electrodes, lubricants, brake linings, and heat-resistant components due to its high thermal stability and conductivity.
<b>Durability and Stability</b>	Decomposes and burns easily, limiting its use in engineering.	High thermal resistance and chemical stability, making it ideal for high-temperature environments.



**WOOL**



# WOOL ✨

Wool is a natural fiber obtained from the fleece of sheep and certain other animals, known for its warmth, softness, and resilience in textiles.



## **HOW DID THEY FORM:**

Wool fibers grow continuously from follicles in a sheep's skin, where specialized cells produce keratin, the primary protein in wool. Variations in cell growth create the wool's natural crimp, while sebaceous glands secrete lanolin, providing water resistance and protection. This results in an insulating fleece, which is sheared annually for textile use.

## **PROPERTIES OF WOOL:**

Wool is a natural, renewable, and biodegradable fiber that regulates temperature, wicks moisture, and resists odors. It is elastic, durable, and soft, with natural stain, fire, and UV resistance, making it a versatile and sustainable material.



# EXAMPLES OF WOOL:



Virgin Wool



Merino Wool



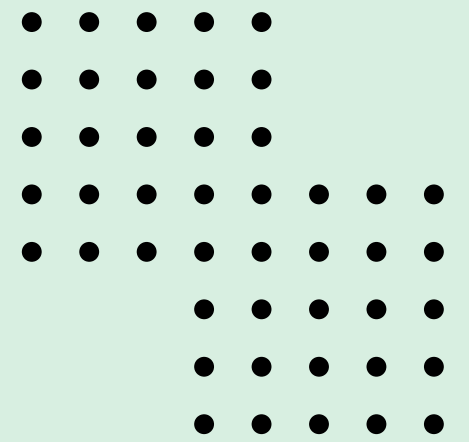
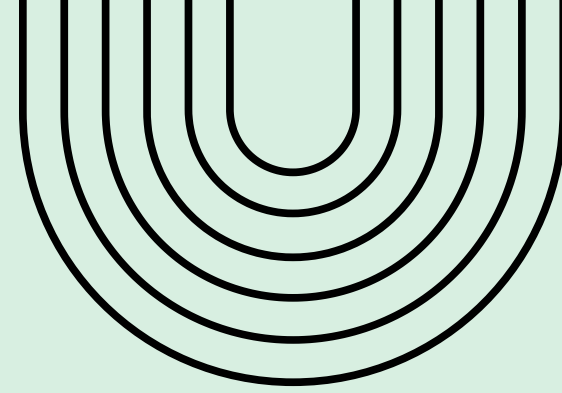
Cashmere



Mohair



Alpaca Wool



## PROCESS OF WOOL:

The production of wool begins with the **shearing**, where wool is harvested from specific animals such as sheep. It is then **scoured** (washed) to remove dirt, grease (lanolin), and impurities before being **carded**, which aligns the fibers into a smooth, fluffy mass. The wool is then **spun** into yarn and either woven or knitted into fabric for clothing, blankets, or textiles. Finally, the fabric undergoes **finishing** treatments such as fulling, dyeing, or brushing to enhance its quality and durability.

# APPLICATIONS ✨ OF WOOL

Wool's natural properties make it fire-resistant, moisture-wicking, and durable, making it ideal for protective gear, activewear, and home furnishings. It is also used for industrial applications like sound absorption and air purification. Sustainability is emphasized, as wool is biodegradable and renewable.

# ADVANTAGES/DISADVANTAGES OF WOOL

## Advantages

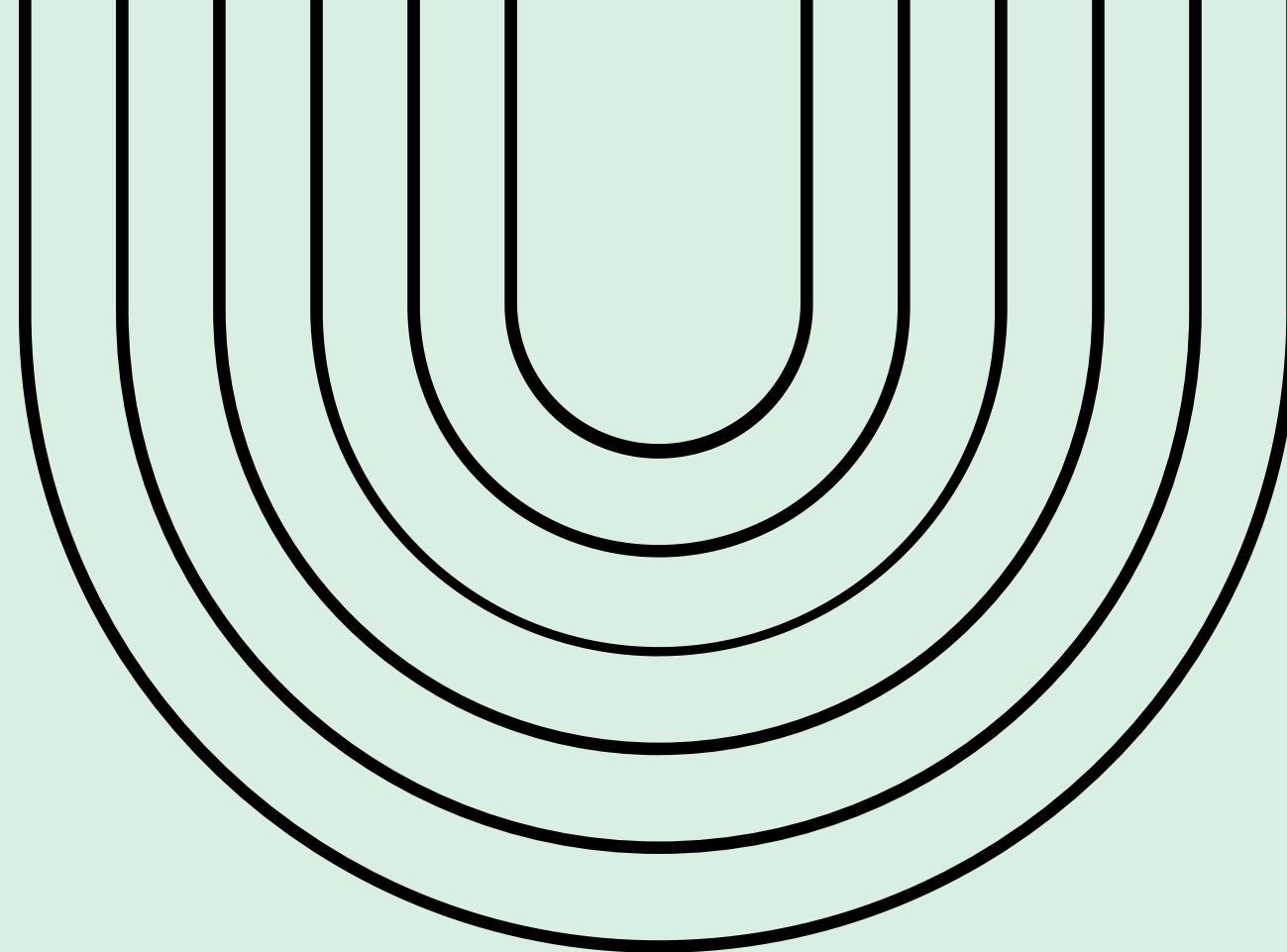
- Heat Insulation
- Moisture-Wicking
- Fire-Resistant
- Durable & Elastic
- Biodegradable & Sustainable
- UV Protection
- Absorbs sound

## Disadvantages

- Expensive
- Prone to shrinking
- Can cause skin irritation (to some people)
- Retains odor
- Slow to dry
- Heavy when wet.



**COTTON**



# COTTON ✨

Cotton fiber is a soft, fluffy natural staple fiber obtained from the seedpods of the cotton plant. This plant belongs to the *Gossypium* genus, which is part of the mallow family (Malvaceae). Classified as a seed hair fiber, cotton is primarily spun into yarn or thread to produce a lightweight, breathable fabric. Today, it remains the most widely used natural fiber in the textile industry, especially for clothing.

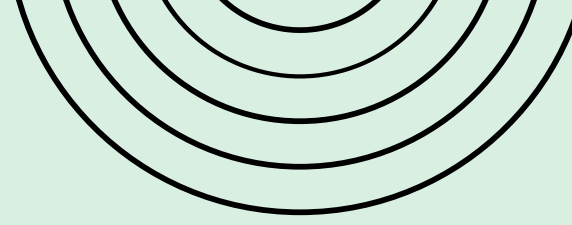


## HOW DID THEY FORM:

Cotton processing begins with **ginning** to separate seeds from fibers, followed by **compressing** the fibers into bales for textile mills. In **ring spinning**, fibers are cleaned, carded, combed, drawn, roved, and spun into yarn. Advanced methods like **rotor** and **air-jet spinning** increase efficiency. **Weaving** then interlaces warp and weft yarns on looms to create durable fabrics.

## PROPERTIES OF COTTON

Cotton is a strong, breathable, and highly absorbent fiber that becomes stronger when wet but wrinkles easily. It resists alkalis, absorbs dyes well, and can shrink after washing. While it withstands heat, it degrades with prolonged exposure to acids, sunlight, and pollutants. Despite these factors, cotton remains a durable and versatile fabric widely used in textiles.



## PROCESS OF COTTON

1. **Mechanical Cleaning (EVÖC):** Separates fiber tufts, removes plant matter, and forms cakes.
2. **Scouring:** Uses sodium hydroxide to remove waxes, residues, and impurities for better absorbency.
3. **Purifying:** Hydrogen peroxide whitens and cleans fibers without chlorine-based agents.
4. **Fiber Finish:** Applied to reduce friction and improve processability.
5. **Final Processing:** Cotton is opened, dried, and baled for high-quality fiber production.

## APPLICATIONS OF COTTON

- **Clothing:** Used for t-shirts, jackets, denim, sarees, and fine fabrics like muslin.
- **Home Furnishings:** Found in bed sheets, towels, curtains, carpets, and mats.
- **Medical Uses:** Used for absorbent cotton rolls, bandages, medical pads, wipes, and earbuds.
- **Miscellaneous Items:** Used in cloth bags, diapers, canvases, bookbinding, and beauty products.
- **Versatility:** Cotton's strength, absorbency, and adaptability make it essential across industries.



# ADVANTAGES/DISADVANTAGES OF COTTON

## ✦ Advantages

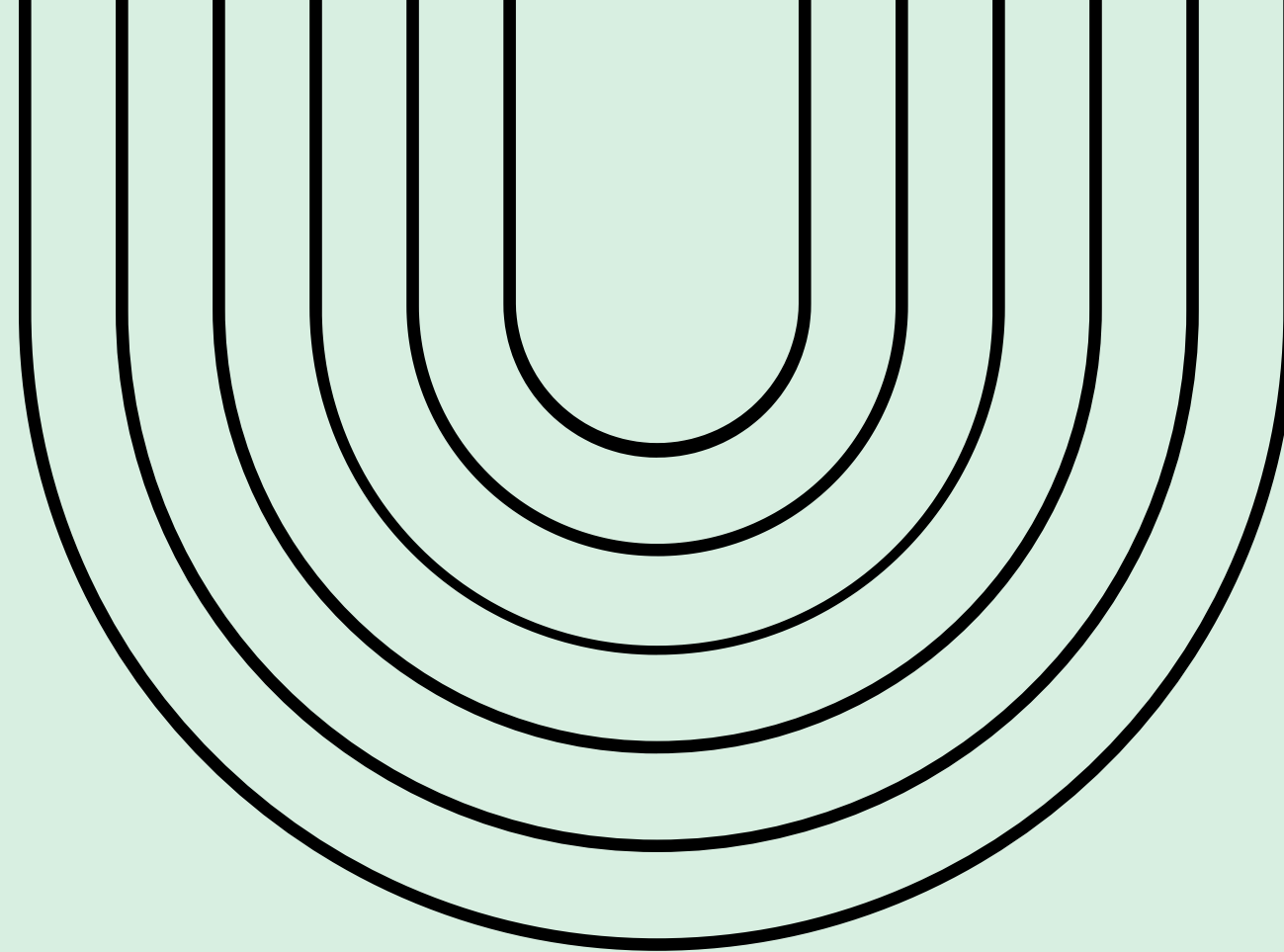
Cotton fiber is valued for its softness, breathability, absorbency, and durability, making it ideal for clothing, bedding, and personal care products. It is hypoallergenic, environmentally friendly, and easily dyed, allowing for vibrant colors. These qualities make cotton a versatile and popular material.

## ✦ Disadvantages

Cotton has some disadvantages, such as wrinkling easily, shrinking in hot water or high heat, and its color fading under sunlight. It is not suitable for water-resistant or moisture-wicking applications, making synthetic fibers more appropriate for quick-drying needs.



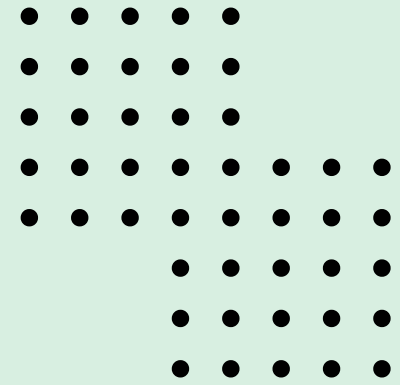
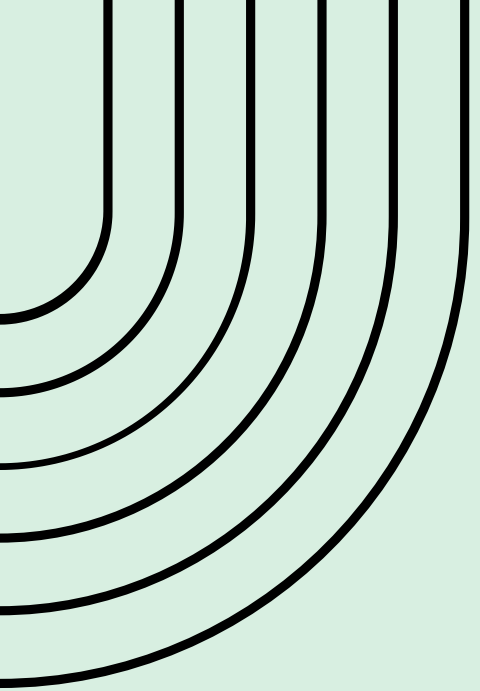
**STONES**



# STONES ✨

Stone is a solid, naturally occurring aggregate of minerals or mineraloids, typically used in construction, architecture, and landscaping.





# ● ● ● ● ● HOW DID THEY FORM?



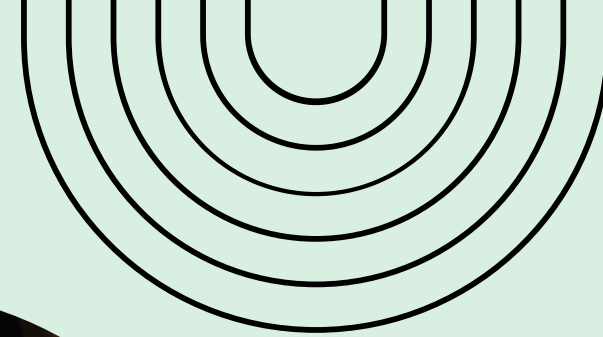
In material science, stones form through geological processes such as igneous crystallization, sedimentation, and metamorphism. Igneous rocks form from cooled magma, sedimentary rocks from compacted mineral



# PROPERTIES OF STONES



Stone properties encompass physical attributes like density, hardness, strength, durability, and resistance to fire and weathering, crucial for applications like construction and engineering.



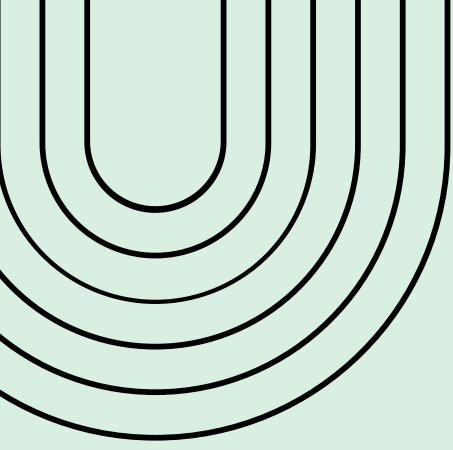
# **PROCESS OF STONES**

**Stone processing includes quarrying, cutting, crushing, polishing, and chemical or heat treatments to enhance durability and aesthetics. Some stones undergo sintering, compaction, or reinforcement for industrial applications.**

# APPLICATIONS OF STONES ✨

**Stones are used in a variety of ways. In construction, stones are used to build foundations, walls, lintels, columns, flooring, retaining walls, etc. For ornamental and architectural works, stones are used commonly for face works. When sand is not available, stone dust is used in place of sand.**





# ADVANTAGES/DISADVANTAGES OF STONES

## ✦ Advantages

**Stones give attractive finishes as well as smoothness on the surface. Stones are also very evenly coloured, easy to shape and the texture improves with time. Stones offer thermal and noise insulation and is resistant to heat and fire.**

## ✦ Disadvantages

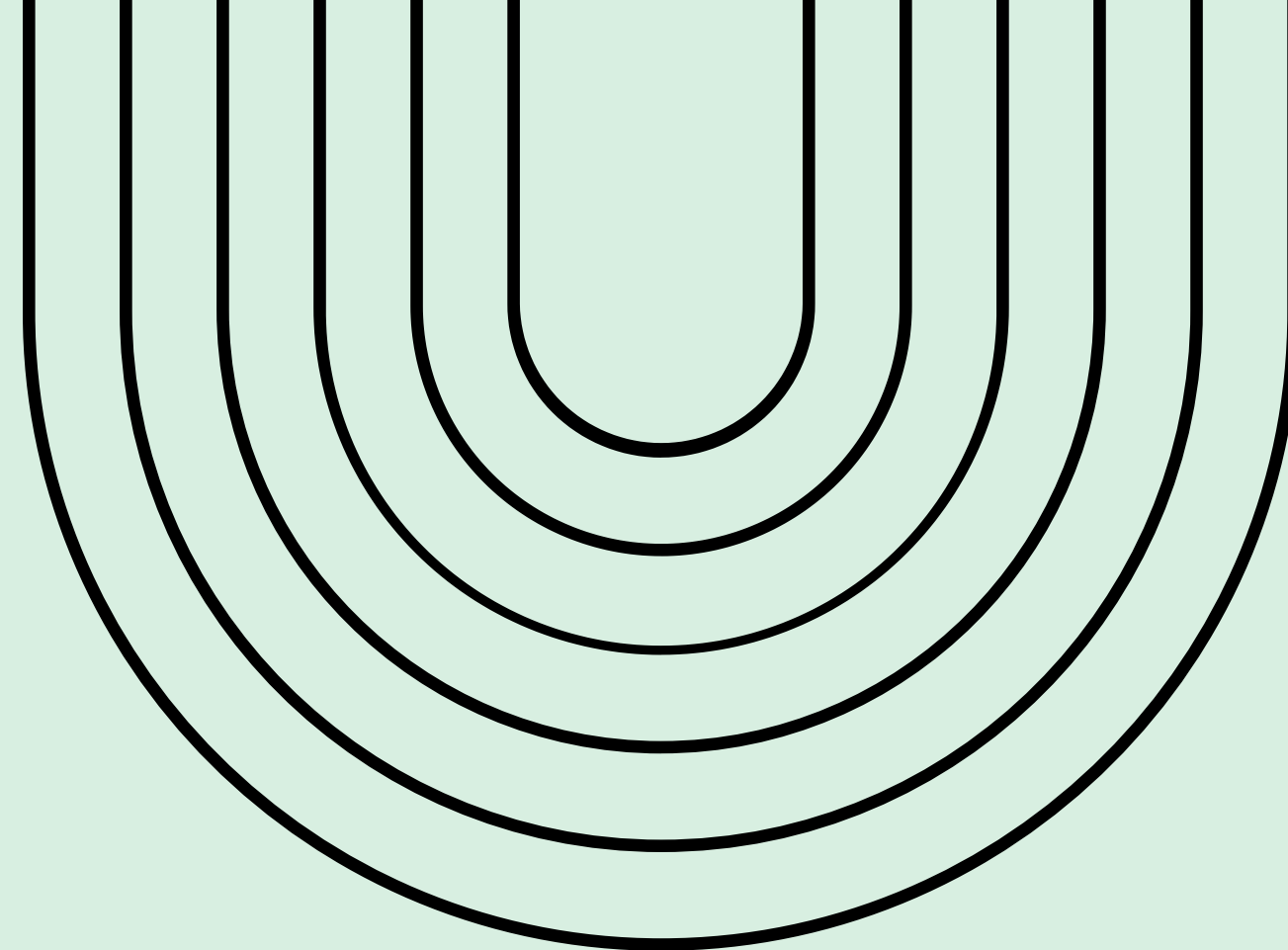
**Stones are susceptible to moisture damage. They are very costly to construct, and giving suitable finishes costs even more as well as this process is time-consuming.**





**NATURAL**

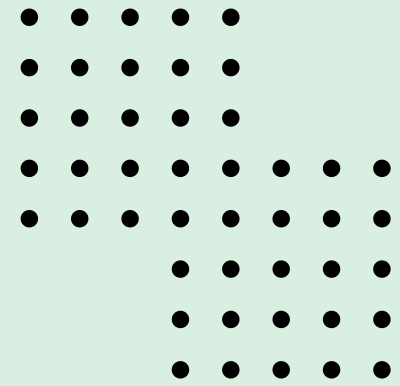
**GAS**



# NATURAL GAS ✨

Natural gas, colorless highly flammable gaseous hydrocarbon consisting primarily of methane and ethane. It is a type of petroleum that commonly occurs in association with crude oil.



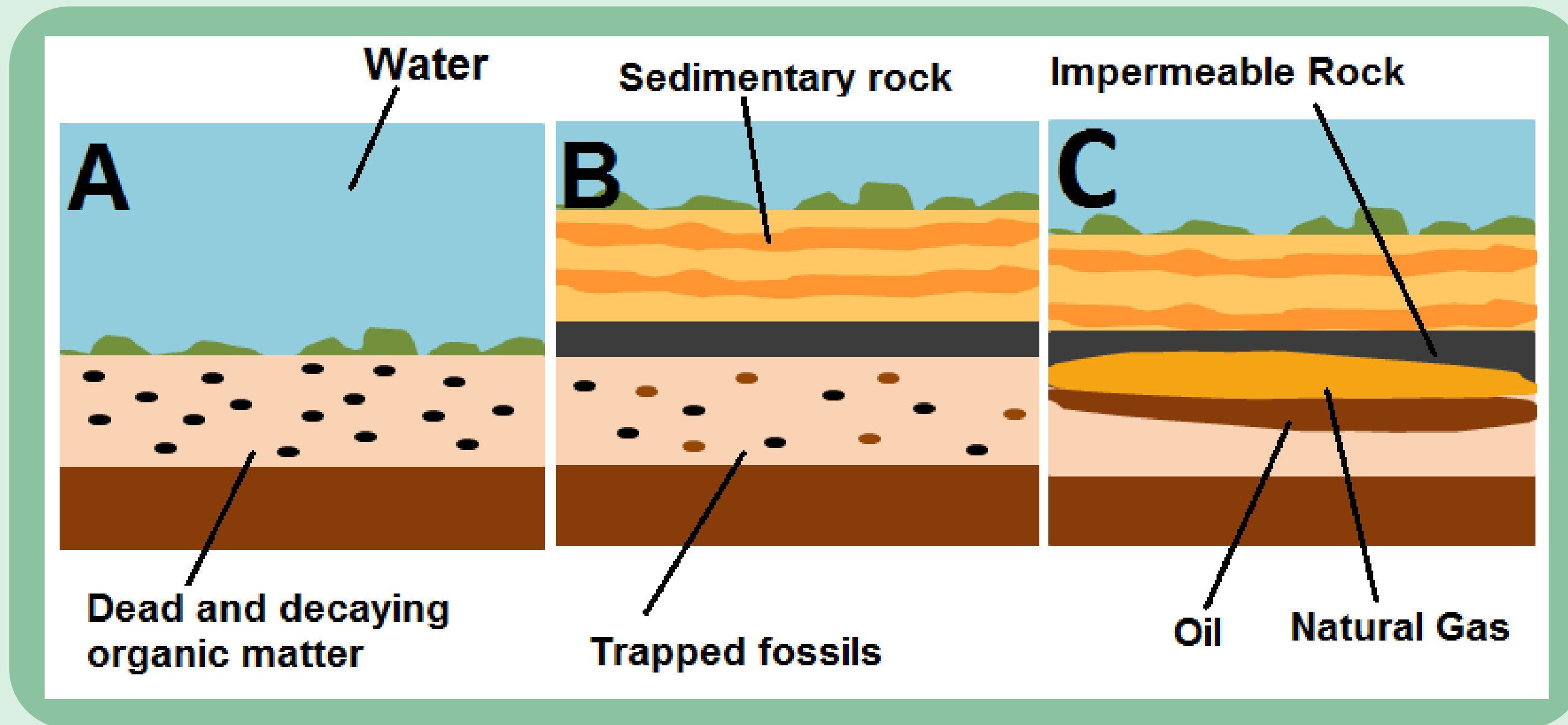


# ● ● ● ● ● **HOW DID THEY FORM?**



**Fossil fuels (coal, oil, and natural gas) formed over millions of years from the buried remains of ancient plants and animals, transformed by heat and pressure.**

# ● ● ● ● ● HOW DID THEY FORM?



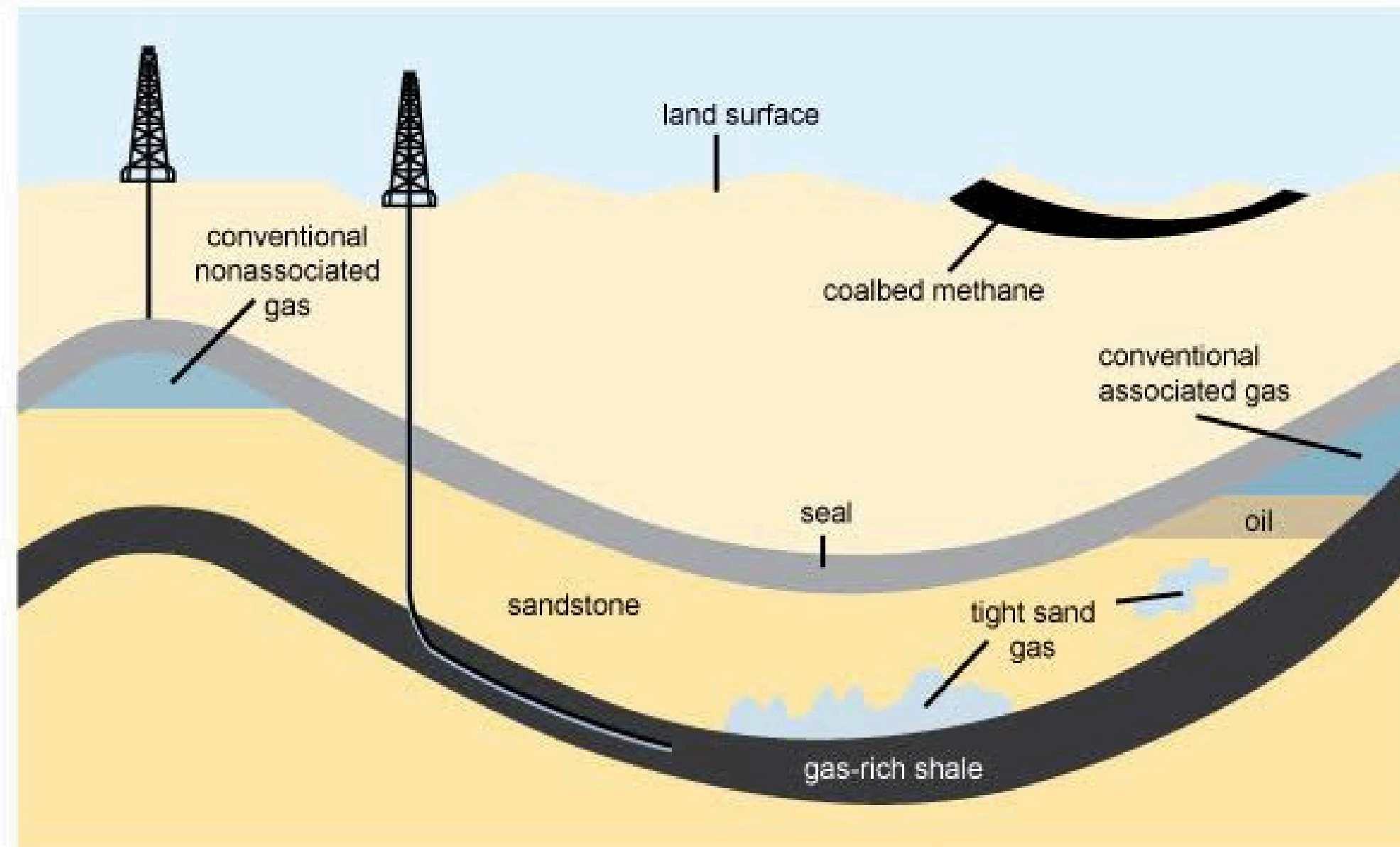
# ..... WHERE CAN THEY BE FOUND? .....

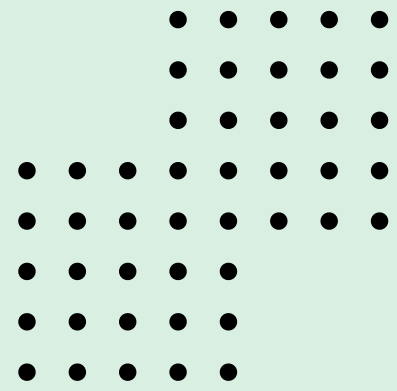
Natural gas is found in various formations: conventional (large cracks), unconventional (shale/tight gas in pores), associated (with crude oil), and coalbed methane (in coal deposits), both onshore and offshore.



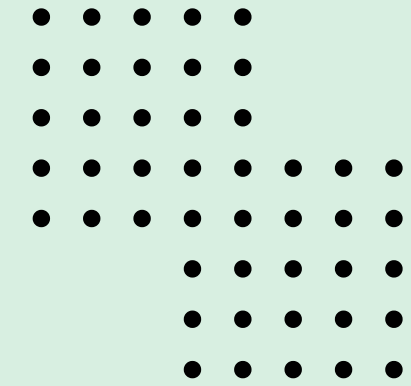
# WHERE CAN THEY BE FOUND?

Schematic geology of natural gas resources





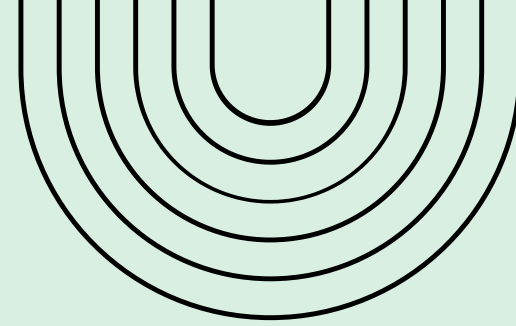
# PROPERTIES OF A ✨ NATURAL GAS



- **Physical Properties:** Colorless, tasteless, odorless (with added mercaptan for leak detection), and lighter than air.
- **Chemical Properties:** Combustible, primarily methane with other hydrocarbons, producing water vapor and carbon dioxide when burned.
- **Safety:** Non-toxic, burns cleanly, but requires careful handling due to its flammability.
- **Source and Transport:** Extracted from porous sedimentary rocks and transported via pipelines.



# COMPOSITION OF NATURAL GAS



## HYDROCARBON CONTENT

Natural gas is a hydrocarbon mixture, mainly composed of methane and ethane, with smaller amounts of other hydrocarbons like propane, butane, pentane, and hexane.

## NONHYDROCARBON CONTENT

Besides hydrocarbons, natural gas mixtures often contain non-combustible gases like nitrogen and carbon dioxide, as well as hydrogen, helium, and argon.

# EXAMPLES OF NATURAL GAS

## 1. METHANE (CH<sub>4</sub>)

Methane, the primary component of natural gas, is a potent greenhouse gas, meaning it traps heat in the atmosphere and contributes to climate change. It's also a flammable gas, and its sources include both natural processes and human activities.

uses:

- Electricity generation (gas & steam turbines)
- Cooking, heating, and air conditioning in homes
- For running industrial machinery
- Fertilizer ingredients



# EXAMPLES OF NATURAL GAS

## 2.ETHANE (C<sub>2</sub>H<sub>6</sub>)

Ethane is a colorless, odorless, and flammable gas that is a hydrocarbon and an alkane, found in natural gas and used as a fuel and a feedstock for producing other chemicals, including plastics.

Uses:

- Producing ethylene and polyethylene products
- Used in making packaging, trash liners, insulation, wire and other consumer products



# EXAMPLES OF NATURAL GAS

## 3. PROPANE (C<sub>3</sub>H<sub>8</sub>)

Propane, a colorless, odorless gas, is a common fuel source, often used for heating, cooking, and powering engines, and is also known as liquefied petroleum gas (LPG).

Uses:

- Fuel for engines and vehicles
- Cooking stoves & central heating Barbecue grills (portable fuel source)
- Fueling furnaces, water heaters, and appliances



# EXAMPLES OF NATURAL GAS

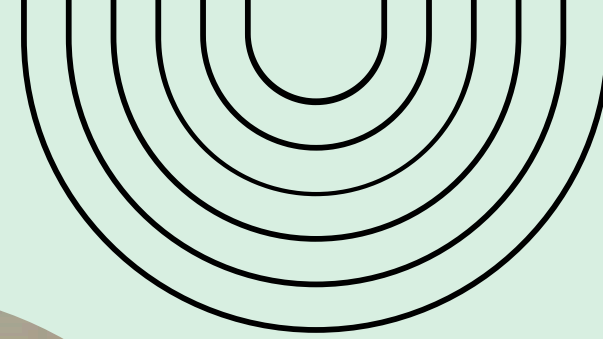
## 4. BUTANE ( $C_4H_{10}$ )

Butane is a hydrocarbon and a highly flammable, colourless, odourless, easily liquefied gas. It is typically used as fuel for cigarette lighters and portable stoves, a propellant in aerosols, a heating fuel, a refrigerant, and in the manufacture of a wide range of products.

Uses:

- Component in automobile gas
- Refrigeration units & lighters
- Aerosol propellant (environmental concerns)





# PROCESS OF NATURAL GAS

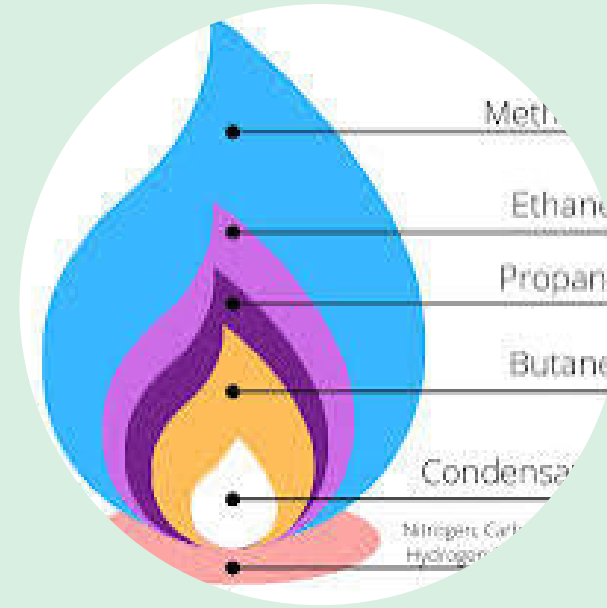
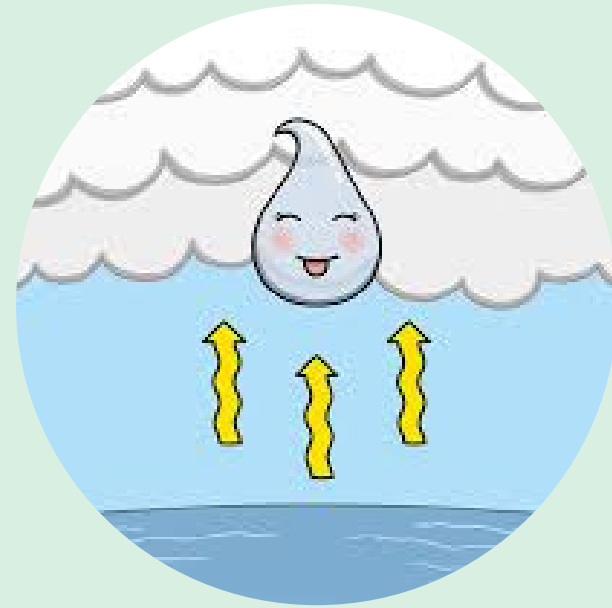
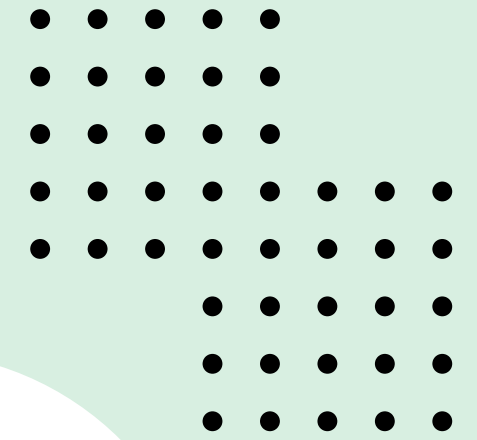
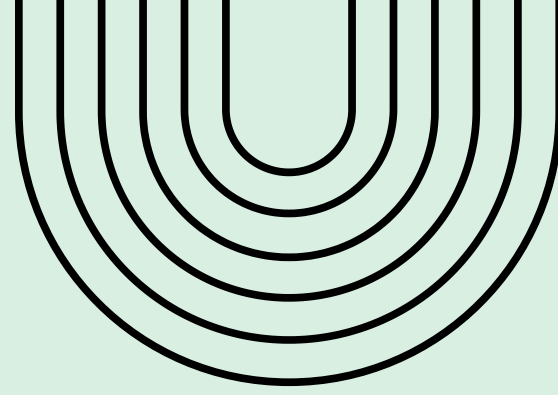
## FORMATION

Natural gas, primarily methane, forms from the breakdown of organic matter (like plankton) under heat and pressure deep within the Earth's crust.

## EXTRACTION

Natural gas is extracted from the ground through wells, and the raw gas, often called "wet gas," contains impurities and other hydrocarbons.

# PROCESSES:



## WATER REMOVAL

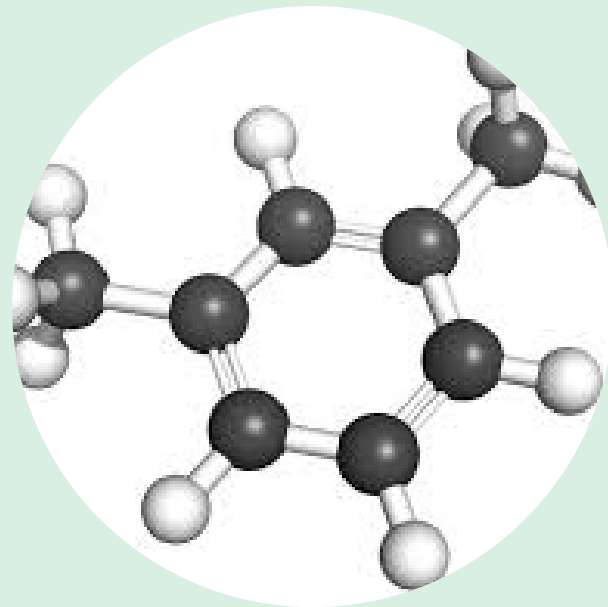
Water vapor is removed to prevent freezing in pipelines.

## LIQUIDS REMOVAL

Natural gas liquids (NGLs) like ethane, propane, and butane are separated from the gas.

## ENRICHMENT

The gas may be enriched with additional hydrocarbons, depending on the desired composition.



## **FRACTIONATION**

NGLs are further separated into their constituent hydrocarbons.



## **HYDROGEN SULFIDE REMOVAL**

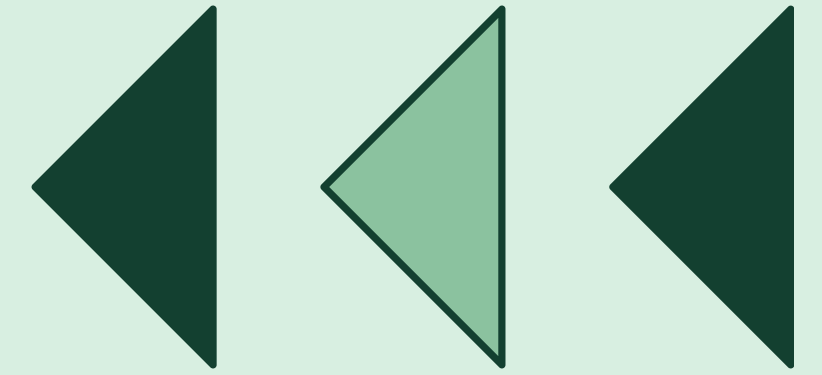
Hydrogen sulfide, a toxic and corrosive compound, is removed and converted to sulfur.



## **TRANSPORTATION**

The processed gas is then transported through pipelines for distribution to consumers.

# USES OF NATURAL GAS



## 1. Energy Generation:

- It's a significant source for electricity generation and heating in residential and commercial settings, including water heating and cooking.

## 2. Industrial and Manufacturing:

- Natural gas is essential for producing chemicals, fertilizers, and hydrogen, and it plays a vital role in general manufacturing processes.

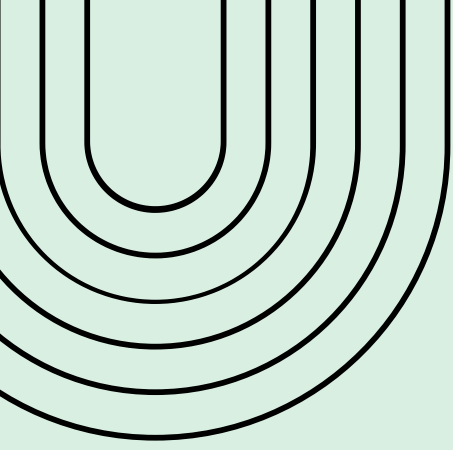
## 3. Transportation:

- While less dominant, it's used as a transportation fuel in natural gas vehicles.

## 4. Other Uses:

- It fuels controlled fires for fireplaces and barbecues.
- Natural gas fields can contribute to economic development.





# PROS AND CONS OF NATURAL GAS

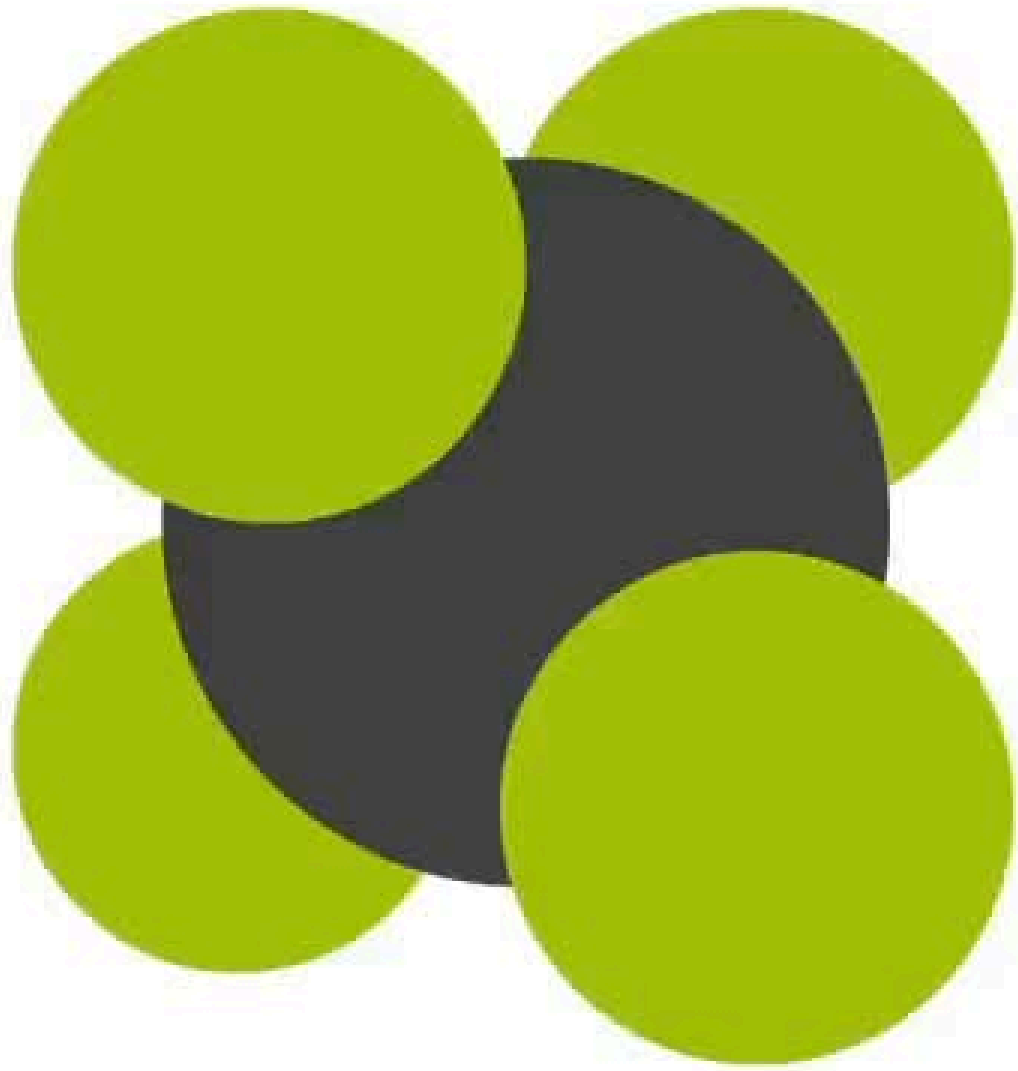
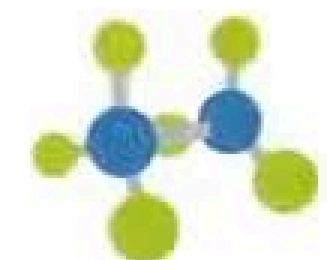
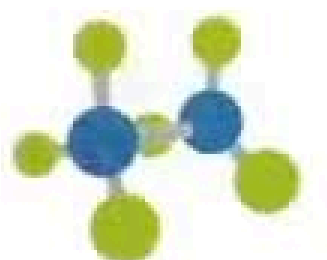
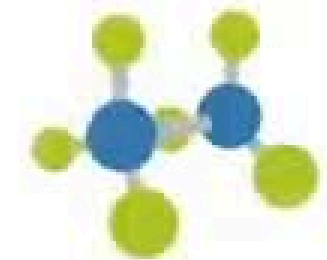
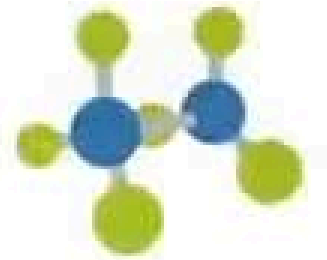
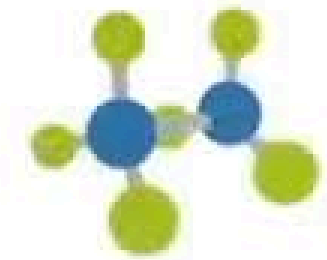
## ✦ Pros

- **Reduced environmental impact compared to other fossil fuels**
- **Power generation efficiency and economic viability**
- **Versatility of applications beyond power generation**

## ✦ Cons

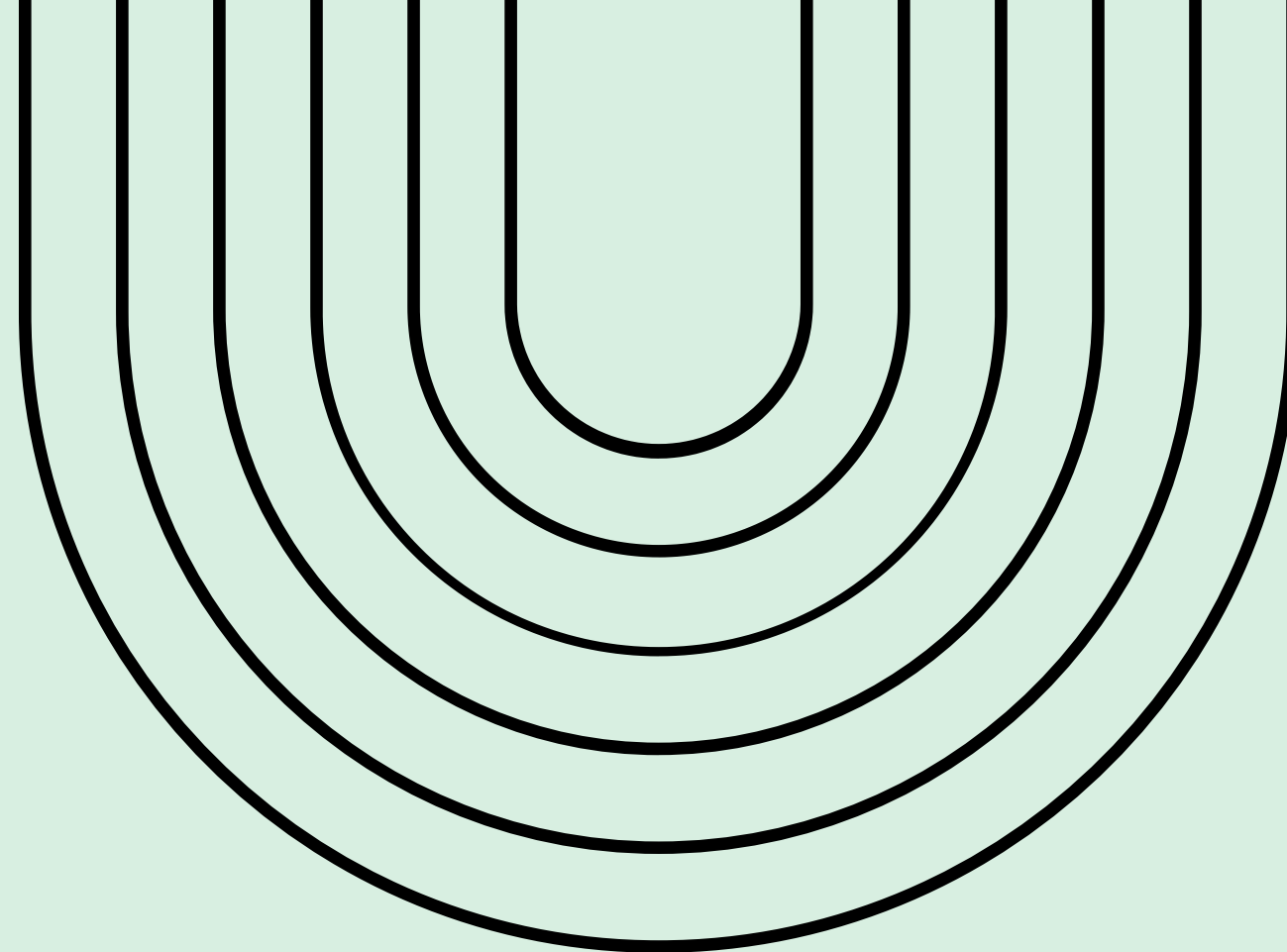
- **Environmental concerns such as methane leaks and fracking**
- **Geopolitics and energy security**
- **Uncertainty of future roles as renewables increase**

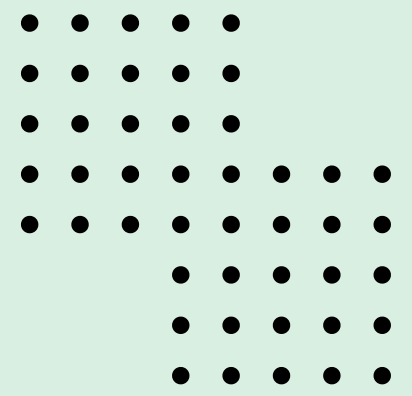
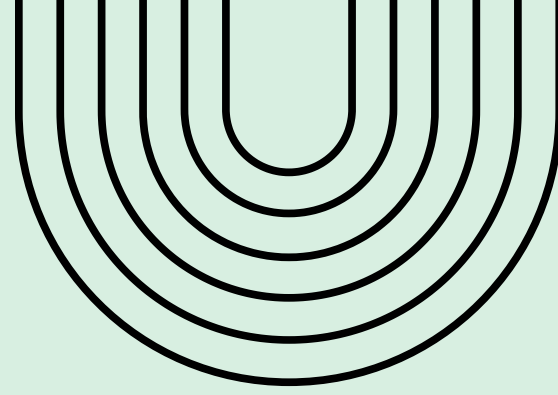
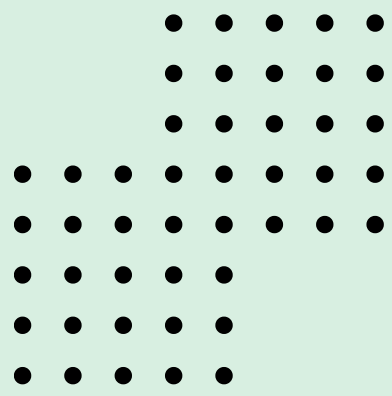
# METHANE (CH<sub>4</sub>)





# SUMMARY

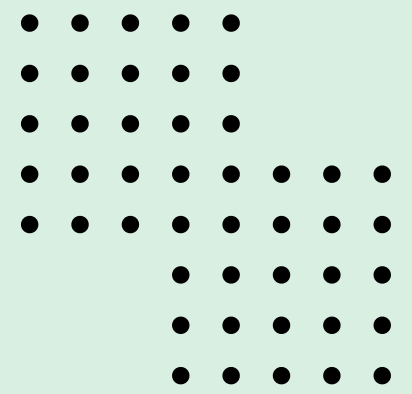
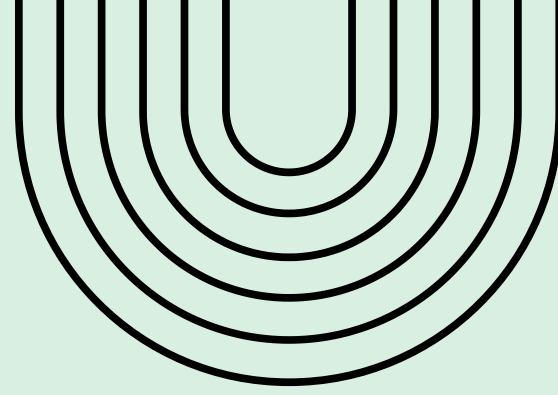
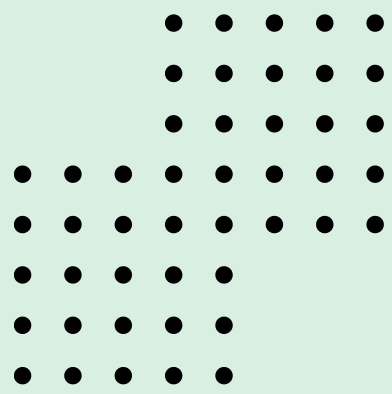




# NATURAL MATERIAL

These occur naturally with minimal processing and include *wood, rubber, oil, coal, graphite, wool, cotton, and stone.*

These form through geological, biological, and chemical processes over time.



# **NATURAL MATERIAL**

**They are widely used in construction, textiles, fuel, energy, food, medicine, and crafts.**

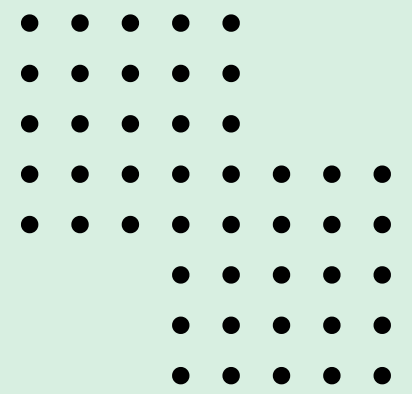
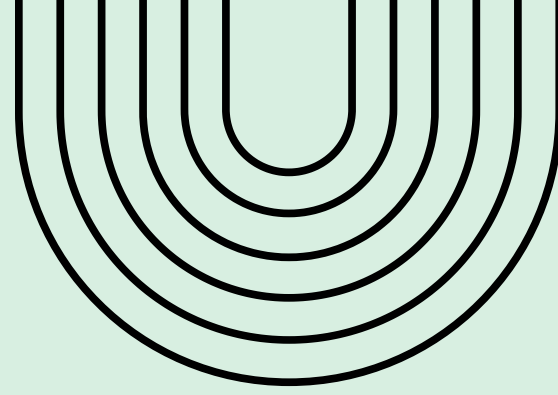
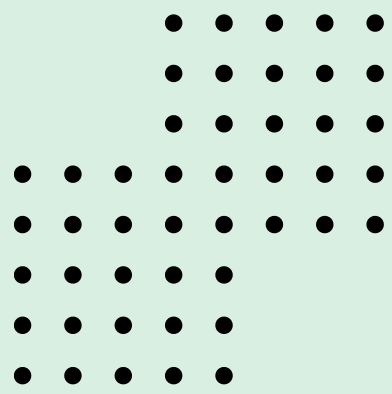
**Each material has unique advantages and disadvantages, influencing its applications.**



# NATURAL GAS

**A fossil fuel composed mainly of methane with small amounts of other hydrocarbons.**

**Formed from organic matter over millions of years under heat and pressure.**



# **NATURAL GAS**

**Extracted, refined, and processed to remove impurities before distribution.**

**Used for electricity generation, heating, transportation, and manufacturing.**



# NATURAL GAS

**While it is more environmentally friendly than other fossil fuels, concerns exist regarding methane leaks and geopolitical dependence.**



**THANK YOU**



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