



FOSSIL FUELS



Coal

1/27/2025



Crude Oil
ELLY KENEDDY

BY ELLY KENEDDY NALITSO
0708838163- 0779031329



Natural Gas



LEARNING

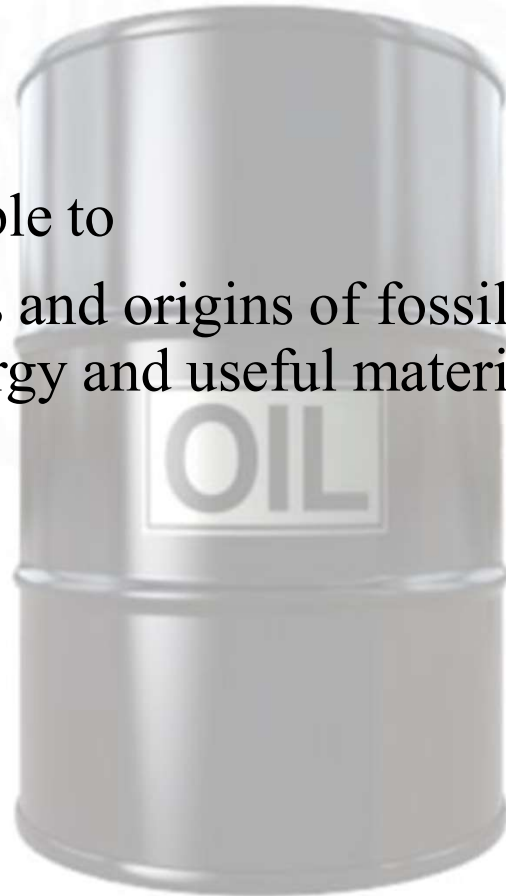
The learner should be able to

- a. understand the types and origins of fossil fuels and why they can be used as sources of energy and useful materials. (u, s)



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INTRODUCTION

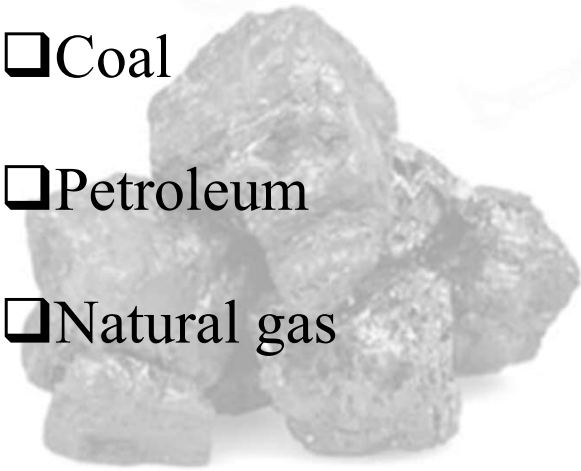
- Fossil fuels are natural resources formed from the decomposed remains of ancient plants and animals buried under layers of sediment and rock for millions of years.

These fuels are rich in carbon and hydrocarbons, making them highly efficient energy sources. There are three primary types of fossil fuels i.e.

☐ Coal

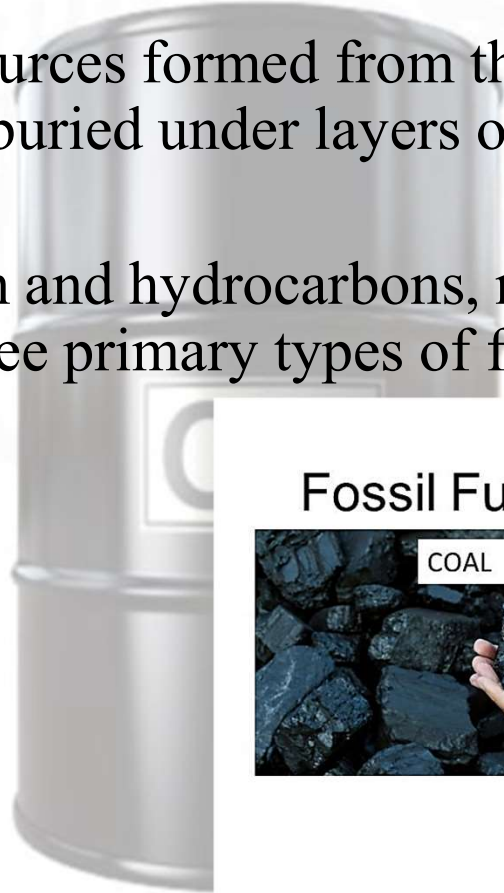
☐ Petroleum

☐ Natural gas



Coal

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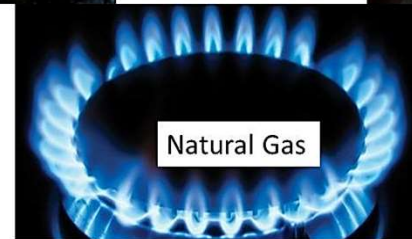
Fossil Fuels



COAL



Petroleum



Natural Gas

COAL

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- Coal *forms from dead plant material* that accumulates in swampy environments and is **subjected to high pressure and heat over millions of years.**

Types of Coal

- **Anthracite**: The highest carbon content, hardest, and most efficient in energy production.
- **Bituminous**: Widely used in power generation and industry due to its high heat content.
- **Sub-bituminous**: Contains less carbon and energy but is cleaner-burning.
- **Lignite**: Lowest carbon content and energy efficiency; primarily used for electricity generation.
- **Uses**: Electricity generation, steel production, and industrial processes.



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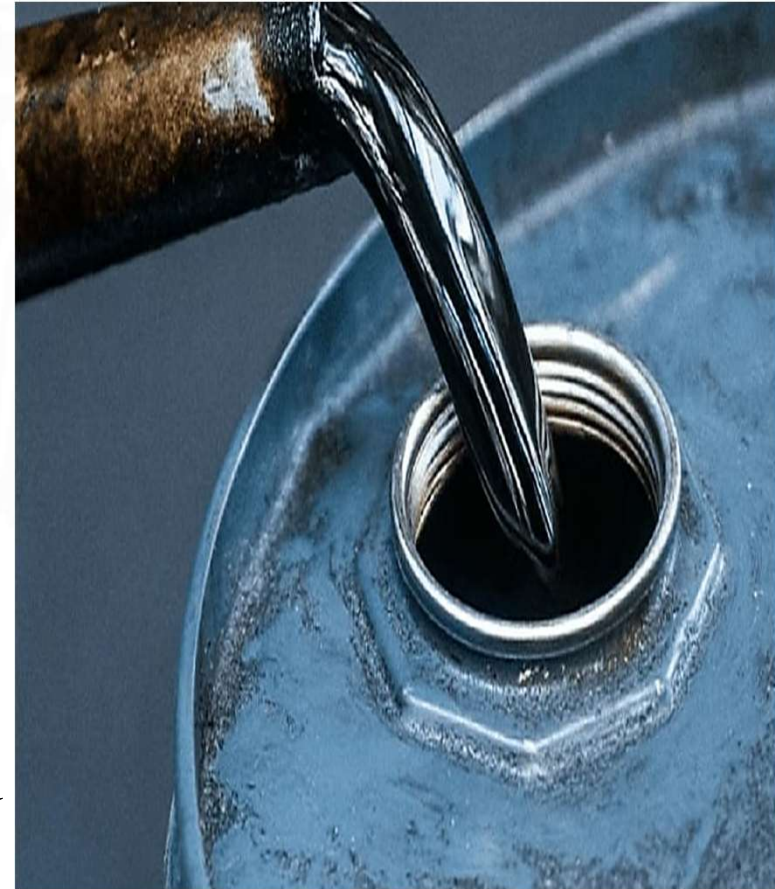
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PETROLEUM (CRUDE OIL)



- **Formation:** Derived from microscopic marine organisms buried under sediment in oceans and subjected to heat and pressure over millions of years.
- **Extraction and Refining:** Crude oil is extracted and refined into products like gasoline, diesel, kerosene, jet fuel, and lubricants.
- **Uses:** Transportation fuels, heating, electricity generation, and as raw materials in the petrochemical industry for plastics, fertilizers, and chemicals.



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NATURAL GAS.



- **Formation:** Often found alongside crude oil, it forms from organic material subjected to even higher pressures and temperatures than oil, resulting in lighter hydrocarbons.
- **Composition:** Primarily composed of methane (CH_4), with small amounts of ethane, propane, and other gases.

Types

- **Conventional Natural Gas:** Extracted directly from underground reservoirs.
- **Unconventional Natural Gas:** Includes shale gas, tight gas, and coalbed methane, which require advanced extraction techniques like hydraulic fracturing.
- **Uses:** Electricity generation, heating, cooking, and as fuel for vehicles.



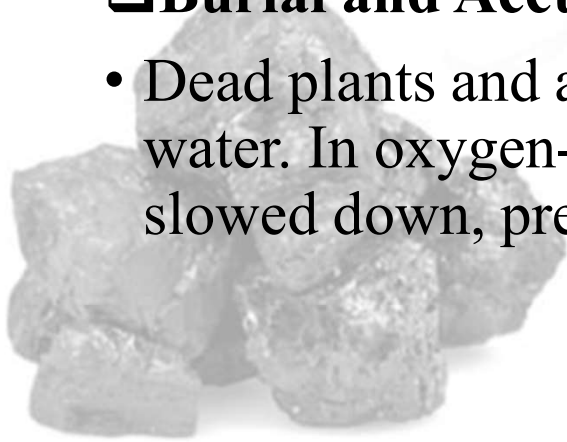


THE PROCESS OF FOSSIL FUEL FORMATION

- The transformation of organic matter into fossil fuels occurs in **several stages**, influenced by **time**, **pressure**, **heat**, and the **type of organic material present**. The stages of formation include.

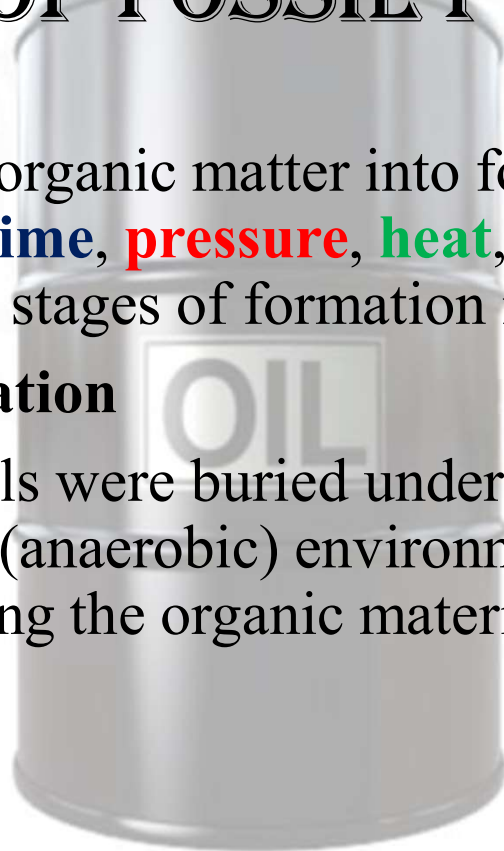
❑ Burial and Accumulation

- Dead plants and animals were buried under layers of sediment and water. In oxygen-poor (anaerobic) environments, decomposition slowed down, preserving the organic material.



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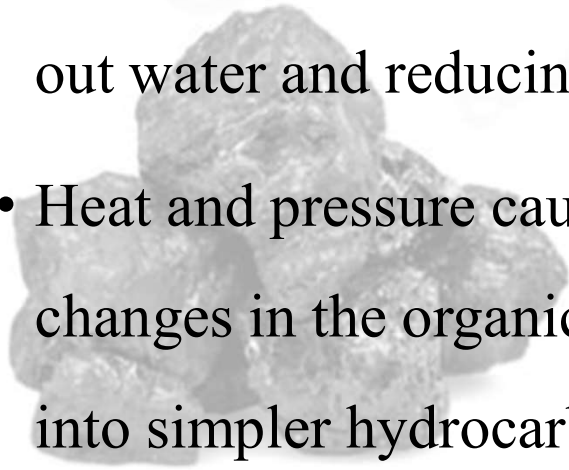
Natural Gas

7



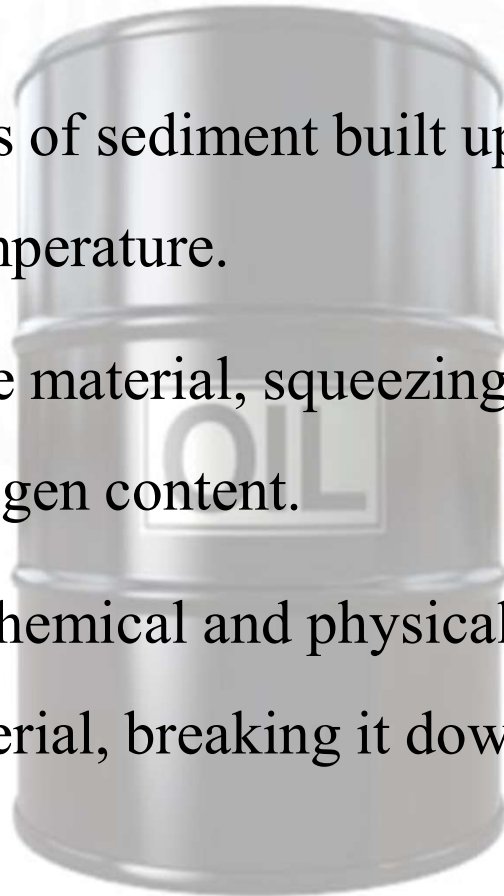
❑ Compaction and Heat.

- Over time, additional layers of sediment built up, increasing pressure and temperature.
- The pressure compacted the material, squeezing out water and reducing oxygen content.
- Heat and pressure caused chemical and physical changes in the organic material, breaking it down into simpler hydrocarbons.



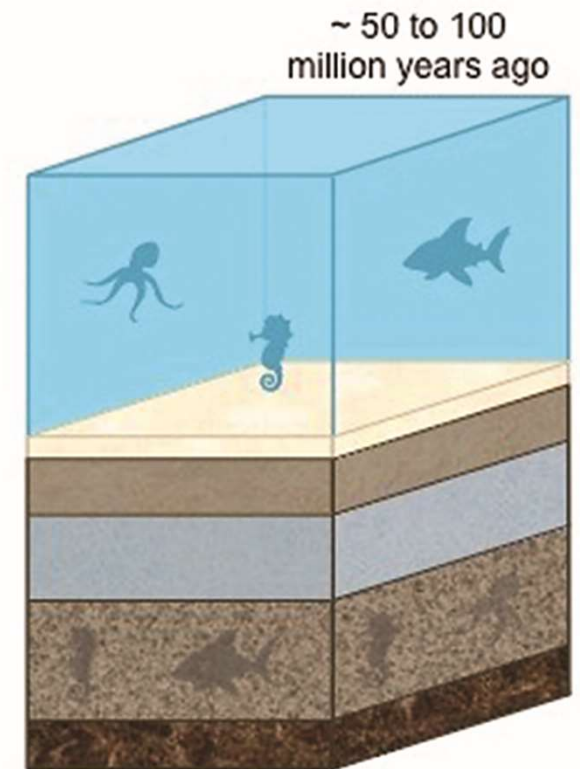
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Layers of sediment are deposited above and the pressure and heat causes compaction of the remains



Increasing heat and carbon content

Increasing moisture content

Peat
(not a coal)



Partially decayed plant matter in swamps and bogs; low heat content

Heat
Pressure

Lignite
(brown coal)



Low heat content; low sulfur content; limited supplies in most areas

Heat
Pressure

Bituminous
(soft coal)



Extensively used as a fuel because of its high heat content and large supplies; normally has a high sulfur content

Heat
Pressure

Anthracite
(hard coal)

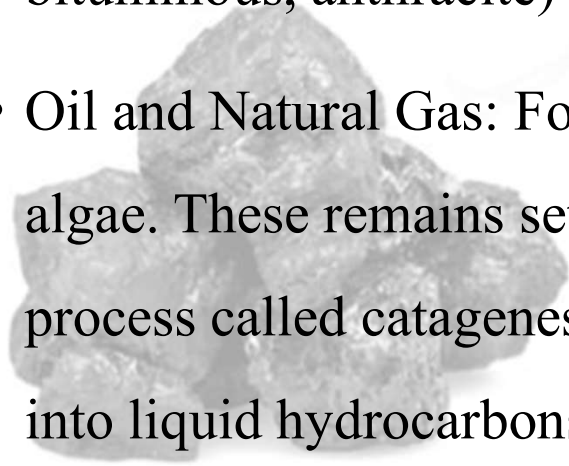


Highly desirable fuel because of its high heat content and low sulfur content; supplies are limited in most areas

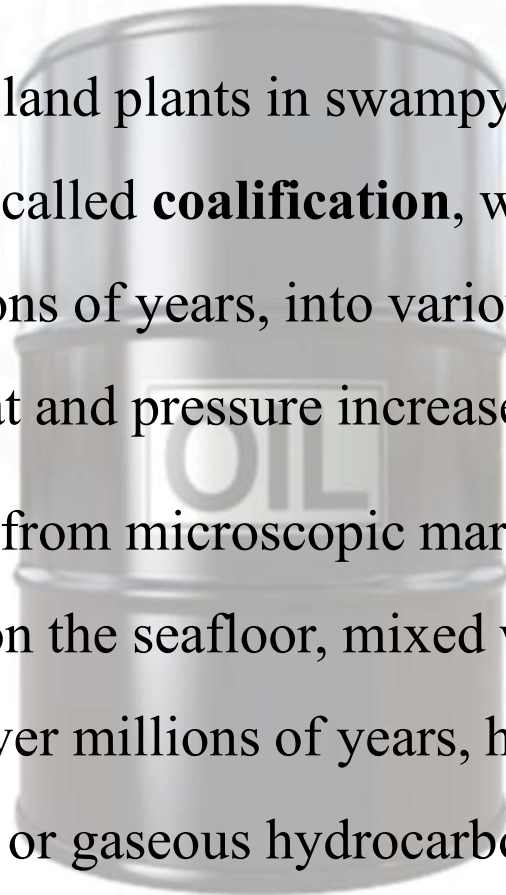


❑ Maturation

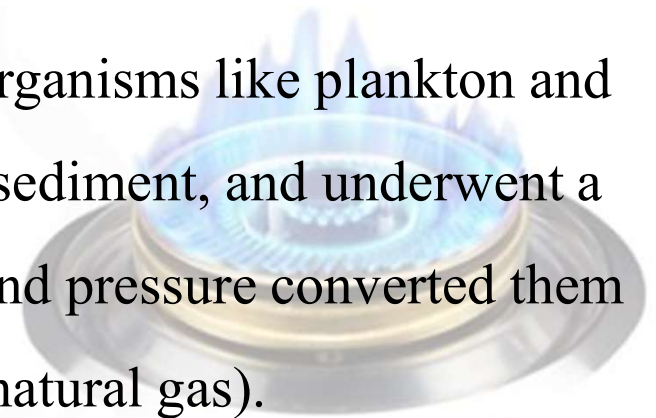
- Coal: Formed primarily from land plants in swampy environments. The organic material underwent a process called **coalification**, where plant matter transformed into peat and then, over millions of years, into various grades of coal (lignite, bituminous, anthracite) as heat and pressure increased.
- Oil and Natural Gas: Formed from microscopic marine organisms like plankton and algae. These remains settled on the seafloor, mixed with sediment, and underwent a process called catagenesis. Over millions of years, heat and pressure converted them into liquid hydrocarbons (oil) or gaseous hydrocarbons (natural gas).



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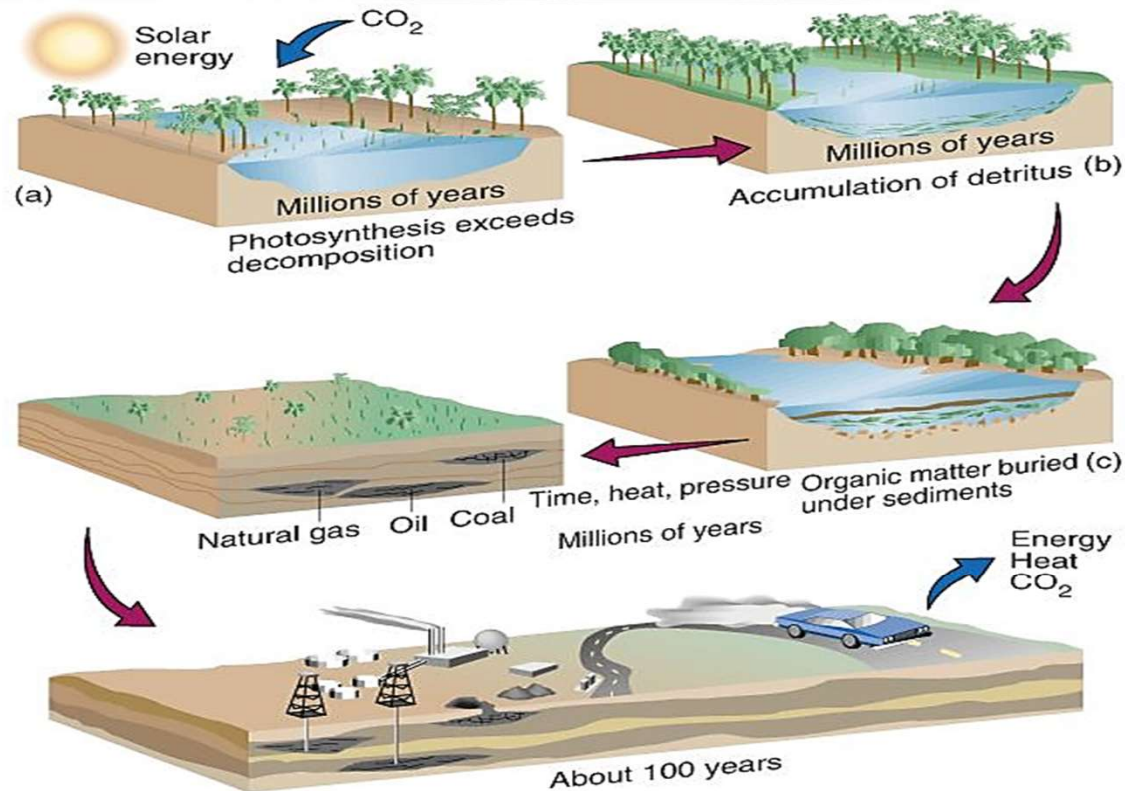


Natural Gas



❑ Migration and Trapping

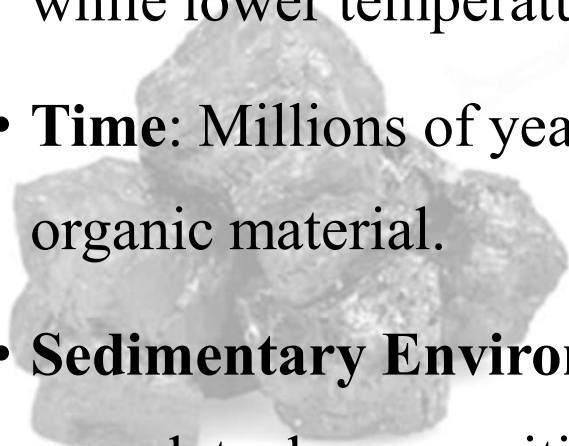
- Once formed, oil and gas migrated through porous rock layers until trapped by impermeable layers, forming reservoirs. Coal remained in solid seams within sedimentary rock formations



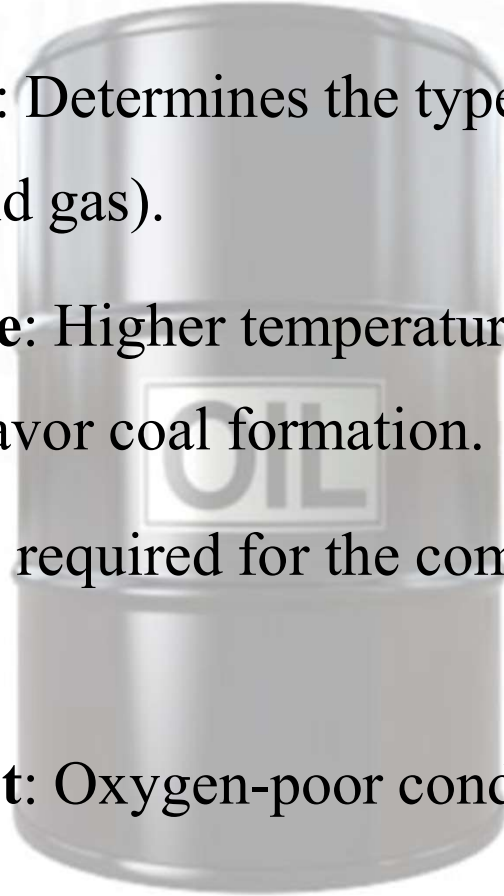
FACTORS INFLUENCING FORMATION



- **Type of Organic Material:** Determines the type of fossil fuel (plants for coal, marine organisms for oil and gas).
- **Temperature and Pressure:** Higher temperatures favor oil and gas formation, while lower temperatures favor coal formation.
- **Time:** Millions of years are required for the complete transformation of organic material.
- **Sedimentary Environment:** Oxygen-poor conditions are essential to prevent complete decomposition



Coal



Crude Oil



Natural Gas

WHY FOSSIL FUELS ARE USED AS SOURCES OF ENERGY

- Fossil fuels can be used as sources of energy due to their high energy content, which is released when they undergo combustion.
- This energy originates from the chemical bonds of hydrocarbons (compounds made of hydrogen and carbon). As the bonds are broken during combustion, energy is given out in form of heat and light.

□ High Energy Density

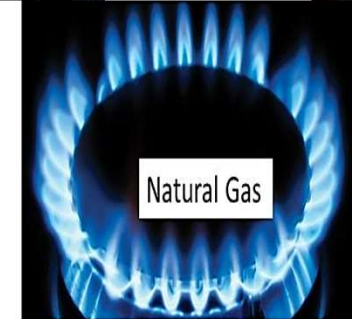
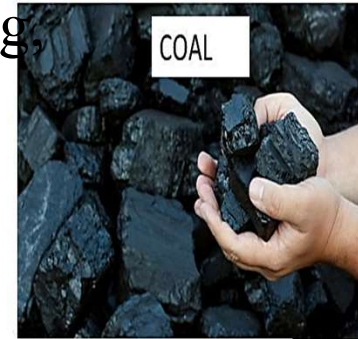
- Fossil fuels (coal, oil, and natural gas) consist largely of hydrocarbons, which contain high-energy chemical bonds. When burnt, these bonds break, releasing significant amounts of energy in the form of heat.
- This high energy density makes fossil fuels highly efficient for generating electricity, powering machinery, and fueling vehicles.



❑ Versatility

- Fossil fuels can be used in multiple forms, making them versatile energy sources:
- **Coal**: Used for electricity generation, heating, and steel production.
- **Oil**: Refined into fuels like gasoline, diesel, and jet fuel for transportation and as raw materials in manufacturing.
- **Natural Gas**: Used for electricity generation, cooking, heating, and as fuel for vehicles.

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□ Abundance and Accessibility

- Fossil fuels have historically been abundant and relatively easy to extract using technologies like drilling and mining.
- The established infrastructure for extraction, transportation, and processing (e.g., pipelines, refineries, and power plants) has made them a reliable energy source.

Examples of fossil fuels



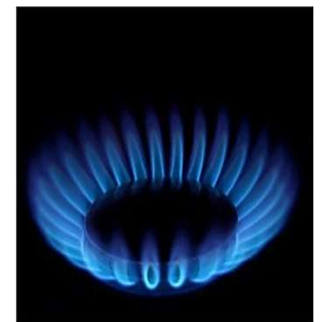
coal



oil



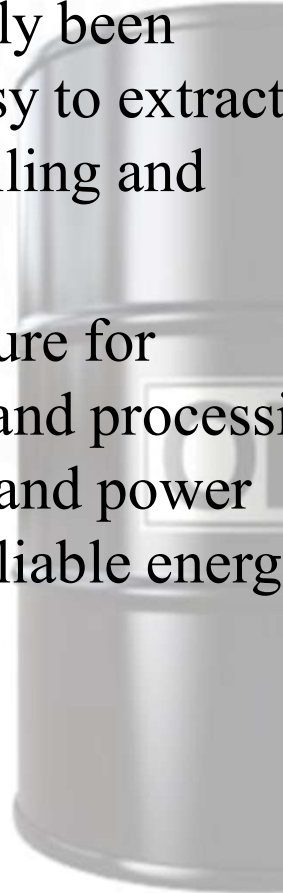
gasoline



natural gas



Coal



Crude

CHARACTERISTICS AND CONCERNS



- **Energy Density:** Fossil fuels are highly energy-dense, making them efficient for large-scale energy production.
- **Environmental Impact:** Burning fossil fuels releases greenhouse gases like CO₂, contributing to climate change, air pollution, and other environmental issues.
- **Non-renewable:** These resources take millions of years to form and are depleting rapidly due to overuse.

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16

ALWAYS AIM FOR EXCELLENCE

BY ELLY KENEDDY NALITSO

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