The Fuel

These notes are your ultimate revision weapon to revise The Fuel. We've distilled years of previous exam questions (PYQs) into one powerful, concise resource. Everything you need to know, nothing you don't.

- **PYQs, Decoded:** All key concepts from past exams, organized and simplified.
- **Revise in Record Time:** Short, precise, and designed for last-minute review.
- **Focus on What Matters:** Master high-probability topics and boost your confidence.

Classification and Sources of Fuels

Fossil Fuels

- **Petroleum:** A natural fuel.
- **Natural Gas:** A fossil fuel; considered the cleanest fossil fuel.
- **Coal:** A fossil fuel.
    - Indian coal has a high ash content.
    - Coal ash contains toxic elements (e.g., arsenic, lead, mercury).
- **Furnace Oil:** A processed product from oil refineries.

Processed & Synthetic Fuels

- **From Coal:**
    - **Coal Gas:** A manufactured product (not natural). Major constituents: Hydrogen, Methane, Carbon Monoxide.
    - **Coke:** A solid carbon-rich fuel produced from coal.
    - **Tar:** A manufactured product from coal.
- **Other:**
    - **Water Gas:** A manufactured mixture of Carbon Monoxide (CO) and Hydrogen (H_2); not a fossil fuel.

Gaseous Fuels

- **Liquefied Petroleum Gas (LPG):**
  - Main components: **Butane and Propane** (main constituent is often Butane).
  - **Indane gas** is a mixture of Butane and Propane.
  - Supplied in cylinders in a **liquid** form.
- **Biogas (including Gobar Gas):**
  - Primarily consists of **Methane (CH_4)** and Carbon Dioxide (CO_2).
  - The 'Gobar Gas' system was invented by **S.V. Desai**.
  - The production process is **Fermentation**.
- **Compressed Natural Gas (CNG):**
  - Stands for **Compressed Natural Gas**.
  - Major component: **Methane (CH_4)**.
- **Piped Natural Gas:**
  - Main component is **Methane**; can be supplied directly through pipelines.
- **Liquefied Natural Gas (LNG):**
  - Natural gas liquefied under extremely cold temperatures and high pressure.
- **Natural Gas Liquids (NGLs):** Separated from LPG; include ethane, propane, butane, and natural gasoline.
- **Gas Emitted from Rice Fields: Methane (CH_4)**.

Fuel Properties, Quality, and Environmental Impact

Fuel Quality Metrics

- **Octane Number:** Measures the **quality of petrol (gasoline)**; indicates anti-knocking properties.
- **Cetane Number:** Measures the **quality of diesel**; indicates ignition delay time.

Fuel Efficiency and Value

- **Highest Fuel Value: Hydrogen** has the highest energy content per unit mass compared to charcoal, natural gas, and gasoline.
- **Vehicle Fuel Efficiency:** Features that improve efficiency include:
    - **Streamlined body** (reduces air resistance).
    - **Multipoint fuel injection** (improves combustion).
    - **Catalytic converter with exhaust** (reduces emissions).

Environmental Impact

- **Cleanest Fossil Fuel: Natural gas**.
- **Maximum Indoor Chemical Pollution:** Caused by **burning coal**.
- **Sulfur Emissions:** Caused by the use of **furnace oil**.
- **Power Plant Pollutants: Coal-fired power plants** release sulfur dioxide (SO_2) and oxides of nitrogen (NOx).
- **Copper Smelting Pollutants:**
    - **Copper slag** can cause leaching of heavy metals.
    - Releases **sulfur dioxide (SO_2)**.

Fuel Applications and Industrial Processes

Metallurgy (Blast Furnace)

- **Fuel/Reducing Agent: Coke** is used with two primary functions:
    1. Acts as a **reducing agent**.
    2. Functions as a **fuel** to supply heat.
- It does **not** act as an oxidizing agent.

Power Generation

- **Furnace oil** is used by some industries to generate power.

Engines

- **Diesel Engine Fuel:** The fuel used is a **vapour of diesel and air**.

Fuel Additives and Special Mixtures

Fuel Additives

- **Anti-Knocking Agent: Tetraethyl Lead (TEL)** was added to petrol to increase its octane rating.
- **Safety Additive (LPG): Ethyl mercaptan** is added to LPG to produce a stench for leak detection.
- **Anti-Freeze Agent: Ethylene Glycol** is used in automobile engines.

Fuel Mixtures

- **Gasohol:** A correct mixture of **Gasoline (Petrol) and Ethyl Alcohol (Ethanol)**.
    - *Incorrect statement:* "Gasohol is a mixture of benzene and alcohol" is **false**.

Clarifications and Corrections

True/False Clarifications

- "The main component of the liquefied petroleum gas is methane" is **FALSE**.
- "Methane can be used directly for burning in homes and factories where it can be supplied through pipelines" is **TRUE**.

General Science Facts

- **Oxygen is absent in:** Kerosene. (It may be present in soil, glass, and cement).
- **Fossil Fuels:** Coal, petroleum, and natural gas.
- **Non-Conventional Energy Source:** Geothermal energy.

Incorrect Facts (from provided options)

- The first LNG terminal in India was **not** built in Hassan. (The first was in Dahej, Gujarat).

- **Hydrocarbon Vision 2025** was **not** primarily about the storage of petroleum products, Euro vehicles, or the Greenhouse effect. (It was a policy for the Indian oil and gas sector.)

Storage and Handling

- **LPG Cylinders:** Pressure gauges are **not** used on domestic LPG cylinders because pressure cannot represent the quantity of gas (it remains constant until the liquid evaporates); quantity is determined by weight.
- **Hydrogen Storage:** Hydrogen gas can be stored for vehicle fuel by being absorbed by **Hydrides** at low temperatures and released by heat.

Know More About The Fuel:

- The Fuel – Old Year Questions
- The Fuel One Liner Questions & Answers