

Medicinal Gases

Medicinal Gases

Definition:

- Medicinal gases are **gases used for therapeutic, diagnostic, or anesthetic purposes**, administered **inhalationally** or via **insufflation** in clinical settings.

Characteristics:

- Stored in **pressurized cylinders**.
- Used in **emergencies, surgeries, respiratory support**, and **diagnostic tests**.
- Must meet **high purity standards** for medical use.

Common Medicinal Gases & Uses:

Gas	Function	Use/Example
Oxygen (O ₂)	Supports cellular respiration	Hypoxia, respiratory failure
Nitrous oxide (N ₂ O)	Analgesic, anesthetic	Dental surgery, labor analgesia
Carbon dioxide (CO ₂)	Stimulates respiration, used in insufflation	Endoscopy, laparoscopy
Helium (He)	Mixed with O ₂ to reduce airway resistance	Severe asthma, upper airway obstruction
Medical air	Clean, filtered air for respiration support	Ventilation in ICUs, nebulizers
Nitric oxide (NO)	Pulmonary vasodilation	Neonatal pulmonary hypertension

Special Uses:

- Anesthesia** – N₂O often used with other anesthetics.
- Resuscitation** – O₂ is critical in emergency care.
- Minimally invasive surgery** – CO₂ insufflation creates space in laparoscopic procedures.
- Diagnostics** – CO₂ in radiology, lung function testing with specific gas mixtures.

Various Medicinal Gases

1. Carbon Dioxide (CO₂)

Chemical Formula

- CO_2

Physical Properties

- Appearance: Colorless, odorless gas
- Taste: Slightly acidic when dissolved in water
- Density: 1.98 kg/m^3 (heavier than air)
- Solubility: Soluble in water, forms **carbonic acid** (H_2CO_3)
- Boiling Point: -78.5°C (sublimes from solid to gas)
- Non-flammable

Chemical Properties

- **Acidic oxide**: reacts with water to form H_2CO_3 , contributing to pH buffering
- Non-toxic at low concentrations but **toxic** in high concentrations ($>5\%$)
- Does not support combustion
- Used as a **respiratory stimulant** at controlled doses

Pharmaceutical Formulations

- Compressed gas in **cylinders** (pure or mixed with O_2)
- $5\% \text{ CO}_2 + 95\% \text{ O}_2$ mixtures (carbogen)
- Supplied as liquefied gas under pressure

Market Preparations

- Medical-grade CO_2 cylinders (green shoulder and grey body in color coding)
- Carbogen mixtures
- Supplied by companies like **Linde, BOC, Praxair**

Storage Conditions

- Stored in **high-pressure gas cylinders**
- Upright position
- Cool, dry place, away from flammable materials
- Use **pressure regulators** for administration

Uses

- **Respiratory stimulant** in cases of apnea or anesthesia recovery (as carbogen)
- **Laparoscopy**: to inflate the abdomen (pneumoperitoneum)
- **Cryotherapy**: solid CO_2 (dry ice) used for wart removal

- Calibration gas for respiratory devices
- Stimulates **cerebral circulation** in certain diagnostic tests

2. Nitrous Oxide (N₂O)

Synonyms

- Laughing gas
- Dinitrogen monoxide
- N₂O

Chemical Formula

- N₂O

Physical Properties

- Appearance: Colorless, sweet-smelling gas
- Taste: Slightly sweet
- Boiling Point: -88.5°C
- Density: 1.98 kg/m³
- Non-flammable, but **supports combustion**
- Stored as a liquefied compressed gas

Chemical Properties

- Inert under normal conditions
- Mild oxidizing agent
- CNS depressant with **anesthetic and analgesic** properties
- Poorly soluble in blood → rapid onset and recovery

Pharmaceutical Formulations

- Pure N₂O gas (99%+ purity) in cylinders
- Often used as **50:50 mix with O₂** (Entonox)
- Supplied under pressure in blue cylinders

Market Preparations

- Entonox® (50% O₂ + 50% N₂O)
- Nitronox® (anesthetic delivery systems)
- Supplied by **BOC Medical, Linde Healthcare**

Storage Conditions

- Compressed in **blue-colored steel cylinders**
- Store upright, below 50°C
- Do not freeze (risk of phase separation)

Uses

- **Analgesic**: for labor pain, minor procedures (e.g., dental, burn dressings)
- **Anesthetic adjunct**: often combined with halogenated agents
- Used in **ambulances** and emergency rooms
- **Dental anesthesia** (conscious sedation)

Cautions

- Long-term exposure may cause **vitamin B12 deficiency**
- Risk of **hypoxia** if not mixed properly with oxygen
- Contraindicated in pneumothorax or bowel obstruction (expands closed air spaces)

3. Oxygen (O₂)

Chemical Formula

- O₂

Physical Properties

- Appearance: Colorless, odorless, tasteless gas
- Density: 1.429 kg/m³
- Boiling point: -183°C
- Slightly soluble in water
- Supports combustion (**essential for life**)

Chemical Properties

- Strong oxidizing agent
- Combines with carbon (C) → CO₂, hydrogen (H) → H₂O
- Essential for **aerobic respiration** in cells
- Reacts with most elements to form oxides

Pharmaceutical Formulations

- Pure medical oxygen (≥99.5% purity) in **green-colored cylinders (India)**

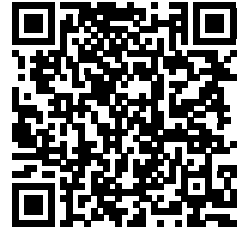


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