BHARATHIDASAN UNIVERSITY

Tiruchirappalli- 20024

Tamil Nadu, India.

Programme

M.Sc., Environmental Science & Sustainable Management

Course Title:

Environmental Pollution & Toxicology(Core Choice)

Course Code: 25PGCC03

Unit-I

Water : Properties, Pollution, and Management

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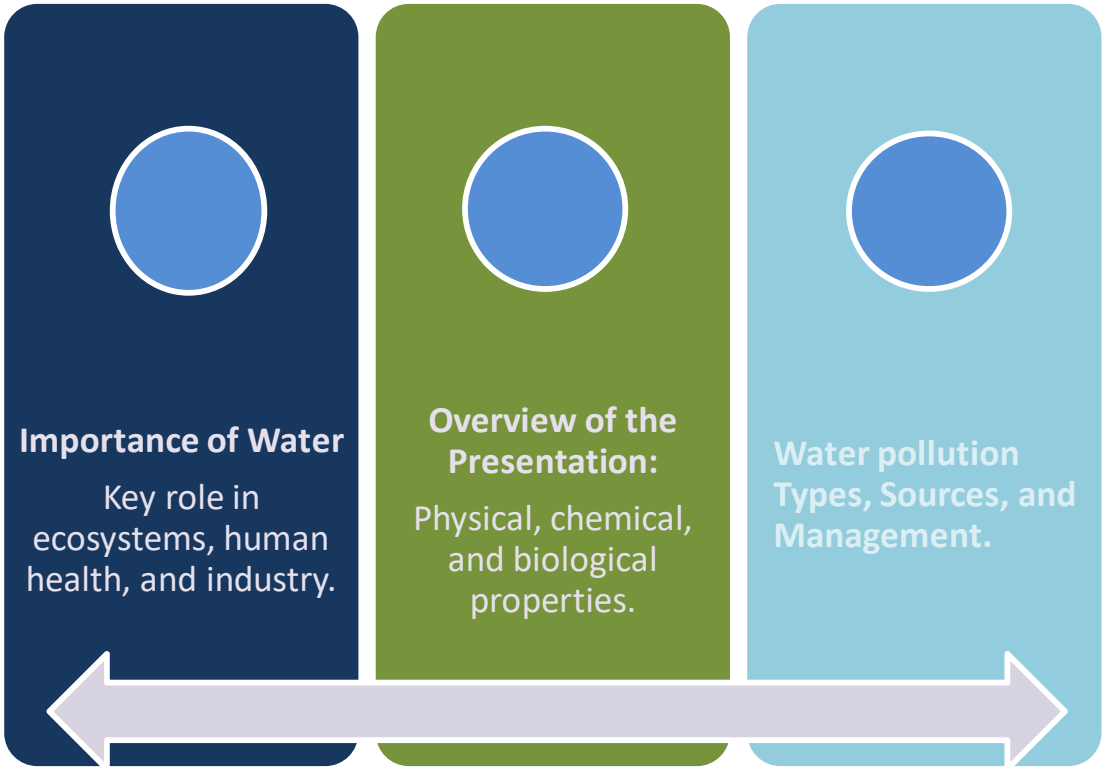
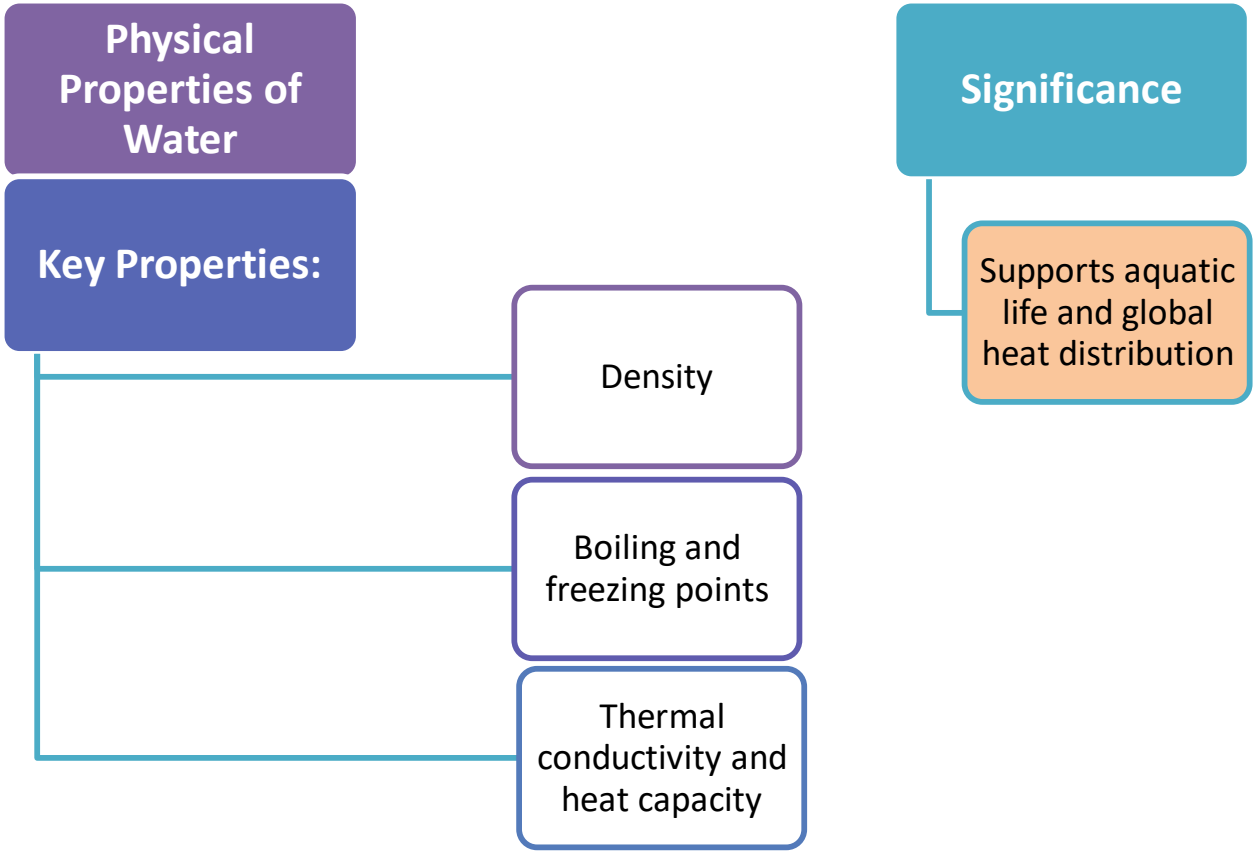
Introduction



Physical Properties of Water



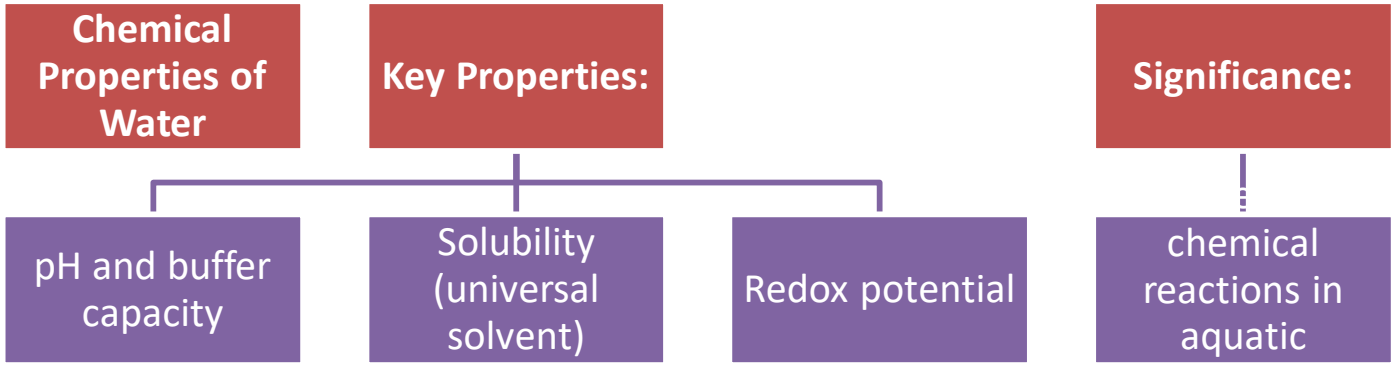
Physical Properties of Water

Pure water exhibits distinct physical, chemical, and biological properties that are essential for various applications and environmental assessments. Understanding these properties is crucial for evaluating water quality, especially in contexts such as bottled water analysis. Below is a summary of the key properties of pure water.

Physical Properties

- **Molecular Weight**: 18.015 g/mol(Yaws, 2015).
- **Freezing Point**: 0°C (32°F)(Kirkham, 2014).
- **Boiling Point: 100°C (212°F) at 1 atm(Kirkham, 2014).**
- Density: Approximately 1 g/cm³ at 4°C(Kirkham, 2014).
- **Surface Tension: 72.8 mN/m at 20°C(Kirkham, 2014).**
- **Viscosity**: 0.89 mPa·s at 20°C(Kirkham, 2014).

Chemical Properties of water



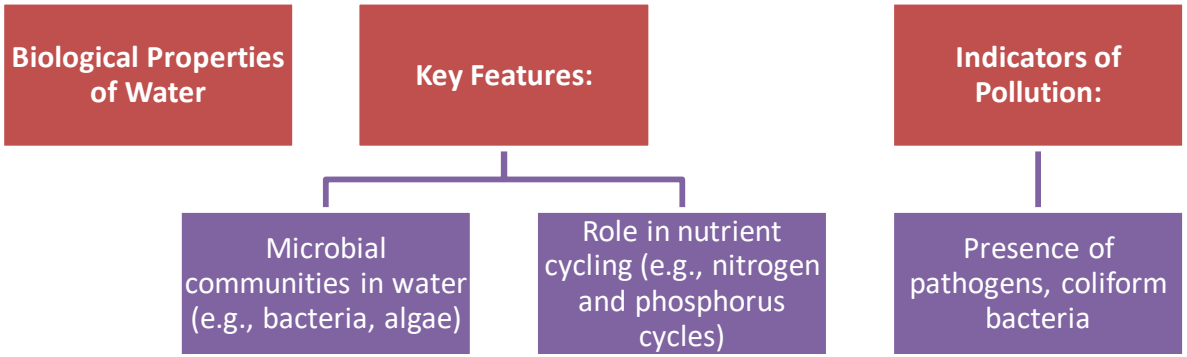
Chemical Properties

pH: Neutral at 7.0 at 25°C(Blanco & Blanco, 2017).

Ion Product: Kw=10−14*Kw*=10−14 at 25°C, indicating equal concentrations of H^+ and OH^- ions(Blanco & Blanco, 2017).

Solvent Properties: Excellent solvent for ionic and polar substances due to its polarity(Blanco & Blanco, 2017).

Biological Properties of water



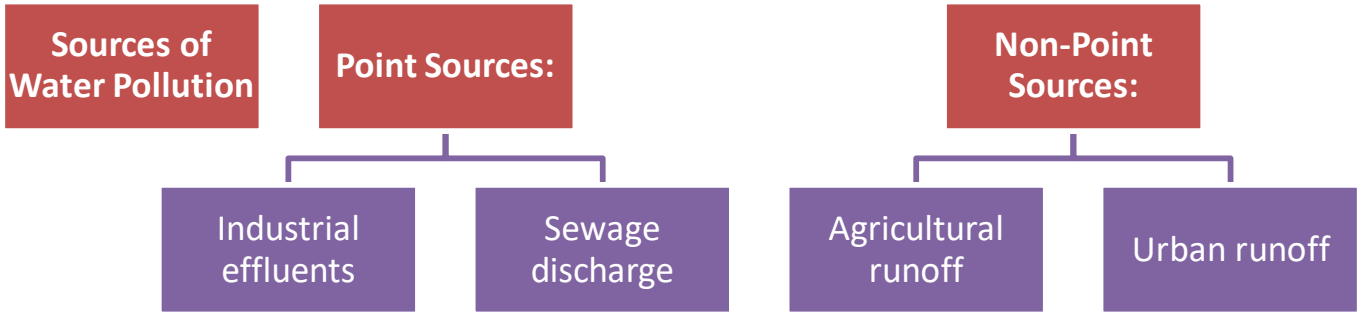
Water: contamination sources

Types of Contaminants

Organic Contaminants: Pesticides, industrial solvents, oils

Inorganic Contaminants: Heavy metals (e.g., lead, mercury); Nitrates and phosphates

Water pollution , sources



Water pollution: Case Study(s)

Case Study – Yamuna River Pollution

Problem Statement:

- Yamuna's high pollutant load from untreated sewage and industrial discharge

Impact:

- Decline in biodiversity, health issues for nearby residents

Mitigation Efforts:

- STP (Sewage Treatment Plants) installation

Interactive Question

Interactive Question 1

Q: What are the main differences between point and non-point sources of water pollution? Provide examples for each.

PM: Impacts on Health

Impact of Water Pollution

On Human Health:

Waterborne diseases: Cholera, dysentery

On Ecosystems:

Eutrophication

Loss of aquatic biodiversity

vector-borne and waterborne zoonoses are expected to increase in the coming years due to the effects of global warming in India (Singh et al., 2011).

The prevalence of waterborne diseases among the elderly population is higher in rural areas (22.5%) compared to urban areas (12.2%) due to the use of unimproved water sources. Central Indian states like Chhattisgarh and Madhya Pradesh, followed by North Indian states, show a higher percentage of waterborne diseases among the elderly (Kumar et al., 2022).

Water pollution :Policies & Regulations

Indian Policies:

Water (Prevention and Control of Pollution) Act, 1974

National Water Policy, 2012

International Examples:

- Clean Water Act (USA)
- EU Water Framework Directive

The National Water Policy (NWP) 2012 aims to ensure the security and sustainability of water resources in India, addressing the challenges posed by limited water availability and increasing demand. The policy emphasizes integrated water resource management, stakeholder participation, and the need for efficient irrigation practices. Key objectives include promoting water conservation, improving water use efficiency, and ensuring equitable access to water resources.

Water pollution :Case study , India

Groundwater Arsenic in West Bengal	
Problem Statement:	• **High arsenic levels affecting millions**
Sources:	• Natural geological factors
Solutions:	• **Installation of arsenic removal filters**

Interactive Question

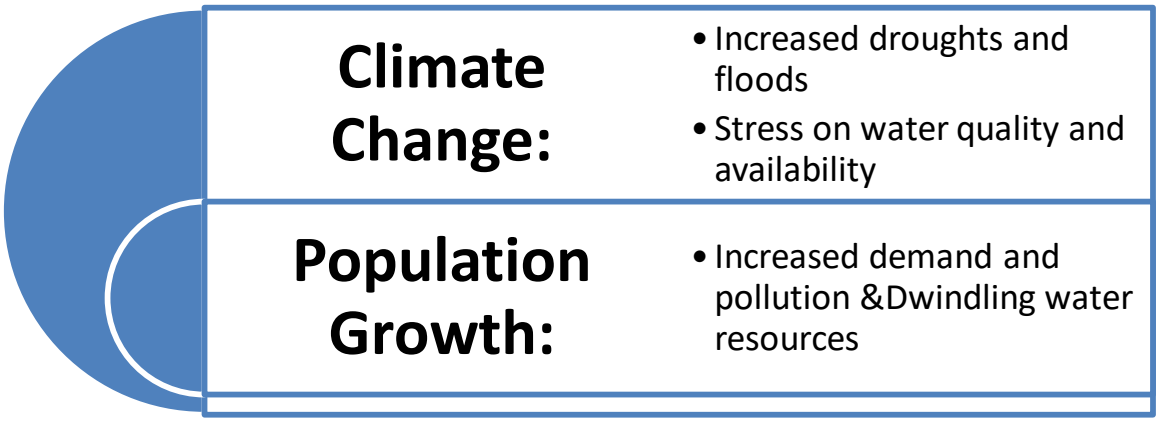
I Q 2: Why is groundwater particularly vulnerable to long-term pollution?

Pollution control Strategies

CASE STUDY II

Case Study – Ganga Action Plan	
Problem Statement:	• **Pollution from urbanization and religious activities**
Government Intervention:	• Cleanup initiatives under **Namami Gange Program**
Outcome:	• Partial success with improved public awareness

Water pollution management:Emerging challenges



Interactive Question

I Q 3: Suggest innovative solutions to reduce urban water pollution effectively.

Summary & Key Takeaways

Properties of water: Physical, chemical, & biological

Major pollutants & sources of water pollution.

Strategies for pollution control & sustainable management.

Case studies from India, highlighting challenges and solutions.

References

Books and Journals:

- "Water Quality Engineering" by Mark Benjamin
- "Environmental Pollution and Control" by C. S. Rao

Reports and Standards:

- CPCB Guidelines on Water Quality Monitoring
- WHO Guidelines for Drinking Water Quality

Websites:

- Ministry of Jal Shakti
- National Water Mission

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