Environmental Health – Exercises and OSPE (PSM)

# Section A: Short Answer Questions

1. 1. Define safe and wholesome water. Enumerate the criteria of potable water.

Answer: Safe and wholesome water: Free from pathogens, harmful chemicals, and acceptable to taste and appearance.  
Criteria: Free from pathogenic organisms, free from harmful chemical substances, pleasant taste, no colour/odour, within permissible limits of dissolved solids, fluoride, nitrates, hardness, etc.

1. 2. Describe the principle and uses of Horrock’s test in chlorination.

Answer: Principle: Determines the chlorine demand of water by adding known increments of bleaching powder solution.  
Uses: Helps calculate the correct amount of bleaching powder required to disinfect a given volume of water.

1. 3. List four major health hazards of poor solid waste management.

Answer: 1. Water pollution and spread of diarrhoeal diseases  
2. Vector breeding (flies, rodents, mosquitoes)  
3. Air pollution (burning waste → respiratory illness)  
4. Aesthetic nuisance and accidents.

1. 4. Enumerate four water-borne diseases with their causative agents.

Answer: 1. Cholera – Vibrio cholerae  
2. Typhoid – Salmonella typhi  
3. Hepatitis A – Hepatitis A virus  
4. Amoebic dysentery – Entamoeba histolytica

# Section B: Calculation Exercises

1. 1. A well has diameter 6 m and water depth 10 m. Horrock’s test shows blue colour in 5th cup. Calculate the bleaching powder needed.

Answer: Volume = πr²h = 3.14 × (3)² × 10 = 282.6 m³ = 2,82,600 L.  
Horrock’s test: 5th cup = 10 g for 455 L.  
Quantity = (2,82,600 ÷ 455) × 10 = ~6.21 kg bleaching powder.

1. 2. A rectangular tank measures 8 × 5 × 4 m. Horrock’s test shows blue colour in 3rd cup. Calculate bleaching powder required.

Answer: Volume = 8 × 5 × 4 = 160 m³ = 1,60,000 L.  
3rd cup = 6 g for 455 L.  
Quantity = (1,60,000 ÷ 455) × 6 = ~2.11 kg bleaching powder.

# Section C: OSPE Stations

1. Station 1: Safe Water

Q: Demonstrate how to test for residual chlorine using orthotolidine test.  
Checklist for examiner:  
- Takes water sample in test tube (1 mark)  
- Adds 1 ml orthotolidine reagent (1 mark)  
- Observes colour change (yellow = free chlorine) (1 mark)  
- Interprets correctly (≥0.5 mg/L = adequate) (2 marks)

1. Station 2: Solid Waste

Q: Show the correct method of segregation of waste at source.  
Checklist:  
- Correctly identifies colour coding (2 marks)  
- Biodegradable, recyclable, biomedical waste segregation (2 marks)  
- Explains importance (1 mark)

1. Station 3: Air Pollution

Q: Identify two ill-effects of indoor air pollution on health.  
Answer: Acute respiratory infections, chronic bronchitis, COPD, lung cancer, low birth weight.

1. Station 4: Vector Control

Q: Demonstrate the identification of Aedes mosquito using specimen provided.  
Checklist:  
- Spots white stripes on legs (1 mark)  
- Recognises day biting habit (1 mark)  
- Identifies disease transmission (Dengue, Chikungunya, Zika, Yellow fever) (3 marks)

# Section D: ETP, STP and Related Aspects

1. 1. Differentiate between STP and ETP.

Answer: STP (Sewage Treatment Plant): Treats domestic/municipal sewage; removes organic matter, pathogens, and nutrients.  
ETP (Effluent Treatment Plant): Treats industrial wastewater; removes toxic chemicals, heavy metals, oils.  
Difference: Type of wastewater (domestic vs industrial) and treatment focus (organic load vs chemical/toxic load).

1. 2. Enumerate the main stages in Sewage Treatment Plant.

Answer: 1. Primary treatment – Screening, grit removal, sedimentation.  
2. Secondary treatment – Biological processes (activated sludge, trickling filter).  
3. Tertiary treatment – Filtration, disinfection, nutrient removal.  
4. Sludge management – Thickening, digestion, disposal.

1. 3. What are the objectives of Effluent Treatment Plant (ETP)?

Answer: 1. Remove organic and inorganic pollutants.  
2. Detoxify harmful chemicals before discharge.  
3. Ensure treated effluent meets CPCB/SPCB standards.  
4. Protect receiving water bodies and public health.

1. 4. Name four byproducts of sewage treatment.

Answer: 1. Treated water  
2. Sludge (biosolids)  
3. Biogas (methane)  
4. Compost/manure

## Calculation Exercise

Q. A town produces 5 million litres of sewage per day (MLD). The STP efficiency is 90%. If BOD of raw sewage is 300 mg/L, calculate the BOD of treated effluent.

Answer:  
Effluent BOD = Raw BOD × (1 – Efficiency)  
= 300 × (1 – 0.9)  
= 30 mg/L  
✅ The treated effluent BOD = 30 mg/L (within CPCB permissible limit ≤ 30 mg/L).

## OSPE Stations

1. Station 5: STP Model Demonstration

Q: Identify the stages of STP in the model provided.  
Checklist:  
- Mentions screening, grit chamber, sedimentation (2 marks)  
- Mentions activated sludge/biological treatment (2 marks)  
- Mentions disinfection before discharge (1 mark)

1. Station 6: Effluent Quality Standards

Q: State the permissible limits for BOD and COD of treated effluent as per CPCB.  
Answer:  
- BOD ≤ 30 mg/L  
- COD ≤ 250 mg/L

1. Station 7: Industrial Pollution

Q: Match the industry with the common effluent pollutant.  
- Tannery – Chromium  
- Textile – Dyes  
- Fertilizer – Nitrates & Phosphates  
- Paper industry – Organic matter (high BOD)

# Section E: Additional Aspects in Environmental Health

## Water Supply & Sanitation

Q1. Enumerate criteria for a safe and wholesome water supply.  
Answer: Free from pathogens, free from harmful chemicals, acceptable taste/odour, adequate quantity, within BIS/WHO permissible limits for turbidity, TDS, fluoride, nitrates, etc.

Q2. Differentiate between slow sand filter and rapid sand filter.  
Answer: Slow sand – biological action, slower rate, less costly; Rapid sand – mechanical & chemical action, faster rate, requires skilled operation.

OSPE: Demonstrate household water purification methods (boiling, filtration, chlorination).

## Waste Management

Q1. State the colour coding for biomedical waste segregation.  
Answer: Yellow – infectious/soiled, Red – plastics, Blue – glass/metal sharps, White – sharps container.

Q2. Describe methods of solid waste disposal.  
Answer: Sanitary landfill, composting, incineration, open dumping (obsolete).

OSPE: Demonstrate correct waste segregation at source using colour-coded bins.

## Excreta Disposal & Sanitation

Q1. Name types of sanitary latrines suitable for rural India.  
Answer: Pit latrine, VIP latrine, septic tank, pour-flush latrine, eco-san toilet.

Q2. What is WHO sanitation ladder?  
Answer: A stepwise model: Open defecation → unimproved latrines → shared facilities → improved sanitation.

OSPE: Identify models/pictures of sanitary latrines.

## Air Pollution

Q1. Enumerate major outdoor air pollutants.  
Answer: SO₂, NOx, CO, particulate matter (PM10, PM2.5), ozone, lead, hydrocarbons.

Q2. List health effects of indoor air pollution.  
Answer: Acute respiratory infections, COPD, lung cancer, low birth weight, cataracts.

OSPE: Identify household sources of indoor pollution (biomass fuel, chulha, incense).

## Housing & Environment

Q1. List criteria of healthy housing (Nightingale’s concept).  
Answer: Site & location, floor area, lighting, ventilation, pure water supply, excreta & waste disposal, protection from dampness and vectors.

Q2. Define overcrowding indices.  
Answer: Persons per room, floor space per person, sex ratio per room.

## Vector Control

Q1. Enumerate anti-mosquito measures.  
Answer: Environmental control (drainage, filling), biological (larvivorous fish), chemical (oils, insecticides), personal protection (nets, repellents).

Q2. Rodent control methods?  
Answer: Environmental sanitation, poisoning, trapping, fumigation.

OSPE: Identify Aedes breeding sites from photographs.

## Climate & Health

Q1. Health impacts of climate change.  
Answer: Heat waves, floods, vector-borne disease expansion, malnutrition, mental health effects.

Q2. Strategies for climate change mitigation.  
Answer: Renewable energy, reducing carbon emissions, afforestation, improved public health preparedness.

## Occupational Health

Q1. List occupational hazards with examples.  
Answer: Physical (noise, heat), Chemical (lead, pesticides), Biological (anthrax, brucellosis), Psychosocial (stress, shift work).

Q2. Prevention of pneumoconiosis?  
Answer: Dust control, ventilation, personal protective equipment, periodic health surveillance.

## Environmental Monitoring

Q1. Define BOD and COD.  
Answer: BOD – oxygen consumed by microorganisms in oxidising organic matter; COD – oxygen consumed in oxidising organic & inorganic matter chemically.

Q2. What is permissible noise pollution limit for residential areas in India?  
Answer: Daytime ≤ 55 dB, Night ≤ 45 dB.

Q3. What is AQI (Air Quality Index)?  
Answer: Composite indicator of air pollution based on PM10, PM2.5, SO₂, NO₂, CO, ozone levels.