

# Environment and Sustainability Solutions

4300003 – Winter 2021

Semester 1 Study Material

*Detailed Solutions and Explanations*

## Question 1 (Any Seven) [14 marks]

### 0.0.1 1. Define the terms: ‘Ecology’ and ‘Ecosystem’.

#### Solution

**Ecology** is the scientific study of relationships between living organisms and their environment. **Ecosystem** is a biological community of interacting organisms and their physical environment functioning as a unit.

Term	Definition	Example
Ecology	Study of organism-environment relationships	Forest ecology
Ecosystem	Living and non-living components interaction	Pond ecosystem

- **Biotic components:** Living organisms in the system
- **Abiotic components:** Non-living factors like air, water, soil

#### Mnemonic

“Every Component Lives Together” (Ecology Creates Living Together)

### 0.0.2 2. Define the terms: ‘Pollution’ and ‘Pollutant’.

#### Solution

**Pollution** is the introduction of harmful substances into the environment causing adverse effects. **Pollutant** is any substance that causes pollution when present in excessive amounts.

Term	Definition	Types
Pollution	Environmental contamination	Air, Water, Soil, Noise
Pollutant	Harmful substance	Physical, Chemical, Biological

- **Primary pollutants:** Directly emitted substances
- **Secondary pollutants:** Formed by reactions in atmosphere

#### Mnemonic

“Pollution Produces Problems” (Pollutants Produce Problems)

### 0.0.3 3. What is noise pollution? What is unit of intensity of sound?

#### Solution

**Noise pollution** is unwanted or excessive sound that disrupts human activities and harms living beings. The unit of sound intensity is **decibel (dB)**.

Sound Level	Source	Effect
30-40 dB	Library	Comfortable
60-70 dB	Traffic	Annoying

90+ dB      Industry      Harmful

- **Threshold of hearing:** 0 dB
- **Threshold of pain:** 120 dB

#### Mnemonic

“Decibels Determine Damage” (dB Determines Damage)

#### 0.0.4 4. What is solid waste management? Give its objectives.

#### Solution

**Solid waste management** is systematic handling of waste from generation to final disposal to minimize environmental impact and protect public health.

#### Objectives:

- **Public health protection:** Prevent disease transmission
- **Environmental protection:** Reduce pollution and contamination
- **Resource recovery:** Recycle and reuse materials
- **Cost effectiveness:** Economic waste handling

#### Mnemonic

“People Expect Resource Conservation” (Protection, Environment, Resource, Cost)

#### 0.0.5 5. Enlist types of solar cells.

#### Solution

Solar cells convert sunlight directly into electricity through photovoltaic effect.

Type	Efficiency	Cost	Application
Monocrystalline	15-20%	High	Residential
Polycrystalline	13-16%	Medium	Commercial
Thin Film	7-13%	Low	Large scale

- **Silicon-based:** Most common type
- **Non-silicon:** Emerging technologies

#### Mnemonic

“Most People Think” (Mono, Poly, Thin-film)

#### 0.0.6 6. What is climate change?

#### Solution

**Climate change** refers to long-term shifts in global temperatures and weather patterns, primarily caused by human activities and greenhouse gas emissions.

#### Causes:

- **Greenhouse gases:** CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O emissions
- **Deforestation:** Reduced carbon absorption
- **Industrial activities:** Fossil fuel burning

#### Effects:

- **Rising temperatures:** Global warming
- **Sea level rise:** Melting ice caps

### Mnemonic

“Change Creates Consequences” (Climate Change Creates Consequences)

#### 0.0.7 7. What is C.F.C?

### Solution

**CFC (Chlorofluorocarbon)** are synthetic compounds containing carbon, fluorine, and chlorine atoms, previously used in refrigeration and aerosols.

#### Properties:

- **Ozone depleting:** Destroys stratospheric ozone
- **Greenhouse gas:** Contributes to global warming
- **Stable compounds:** Long atmospheric lifetime
- **Montreal Protocol:** International ban agreement

### Mnemonic

“Chlorine Fluorine Carbon” (CFC components)

#### 0.0.8 8. Give advantages of ISO-14000.

### Solution

**ISO 14000** is international standard for environmental management systems.

#### Advantages:

- **Environmental compliance:** Meet legal requirements
- **Cost reduction:** Efficient resource use
- **Market advantage:** Enhanced company image
- **Risk management:** Prevent environmental incidents

Benefit	Impact	Result
Compliance	Legal safety	Avoid penalties
Efficiency	Resource saving	Cost reduction
Image	Market position	Competitive advantage

### Mnemonic

“Companies Gain Market Recognition” (Compliance, Cost, Market, Risk)

#### 0.0.9 9. Enlist various Acts related to environment in India.

### Solution

India has comprehensive environmental legislation framework.

#### Major Acts:

- **Air Act (1981):** Air pollution control
- **Water Act (1974):** Water pollution prevention
- **Environment Protection Act (1986):** Comprehensive environmental law
- **Wildlife Protection Act (1972):** Biodiversity conservation
- **Forest Conservation Act (1980):** Forest protection

### Mnemonic

“All Water Environments Wildlife Forests” (AWEWF)

#### 0.0.10 10. Enlist various methods of rainwater harvesting.

##### Solution

**Rainwater harvesting** collects and stores rainwater for future use.

##### Methods:

- **Rooftop harvesting:** Direct collection from roofs
- **Surface runoff harvesting:** From ground surfaces
- **Recharge pits:** Groundwater recharging
- **Check dams:** Stream water collection

Method	Application	Benefit
Rooftop	Urban areas	Direct use
Surface	Rural areas	Large volume
Recharge	Water table	Groundwater

##### Mnemonic

“Roofs Surface Recharge Check” (RSRC)

#### Question 2(a) [3 marks]

#### 0.0.11 Write short note on: Food chain.

##### Solution

**Food chain** represents the flow of energy and nutrients through different trophic levels in an ecosystem.

##### Mermaid Diagram (Code)

```
{Shaded}  
{Highlighting} []  
graph LR  
    A[Producers<br/>Plants] --> B[Primary Consumers<br/>Herbivores]  
    B --> C[Secondary Consumers<br/>Carnivores]  
    C --> D[Tertiary Consumers<br/>Top Predators]  
    D --> E[Decomposers<br/>Bacteria/Fungi]  
{Highlighting}  
{Shaded}
```

- **Energy transfer:** Only 10% passes to next level
- **Biomass pyramid:** Decreases at higher levels

##### Mnemonic

“Plants Provide Primary Power” (Producer to Predator Path)

#### 0.0.12 OR

#### 0.0.13 Explain factors affecting ecosystem.

##### Solution

Ecosystems are influenced by various biotic and abiotic factors.

##### Factors:

- **Climate factors:** Temperature, rainfall, humidity
- **Soil factors:** pH, nutrients, texture
- **Biotic factors:** Species interactions, population density
- **Human factors:** Pollution, habitat destruction

Factor Type	Components	Impact
Abiotic	Climate, Soil	Habitat conditions
Biotic	Organisms	Species interactions
Anthropogenic	Human activities	Ecosystem disruption

### Mnemonic

“Climate Soil Biology Humans” (CSBH)

## Question 2(b) [3 marks]

### 0.0.14 Write short note on: Virtual water

#### Solution

**Virtual water** is the hidden water used in production of goods and services, representing total water consumption in supply chain.

#### Examples:

- 1 kg wheat: 1,300 liters virtual water
- 1 kg beef: 15,400 liters virtual water
- 1 cotton t-shirt: 2,700 liters virtual water
- **Water footprint:** Total virtual water consumption
- **Trade implications:** Water-rich countries export virtual water

### Mnemonic

“Virtual Water Worldwide” (VWW)

### 0.0.15 OR

### 0.0.16 What is biodiversity? Give its types.

#### Solution

**Biodiversity** is the variety of life forms at genetic, species, and ecosystem levels on Earth.

#### Types:

- **Genetic diversity:** Variation within species
- **Species diversity:** Number of different species
- **Ecosystem diversity:** Variety of habitats and communities

```
mindmap
root((Biodiversity))
    Genetic
        DNA variation
        Population genetics
    Species
        Flora
        Fauna
    Ecosystem
        Terrestrial
        Aquatic
```

### Mnemonic

“Genes Species Ecosystems” (GSE)

## Question 2(c) [4 marks]

### 0.0.17 Explain: Carbon cycle

#### Solution

Carbon cycle describes the movement of carbon through Earth's atmosphere, land, water, and organisms.

#### Mermaid Diagram (Code)

```
{Shaded}  
{Highlighting} []  
graph LR  
    A[Atmospheric CO] --> B[Photosynthesis]  
    B --> C[Plant Biomass]  
    C --> D[Animal Consumption]  
    D --> A  
    C --> E[Decomposition]  
    E --> A  
    F[Fossil Fuels] --> A  
    A --> G[Ocean Absorption]  
    G --> H[Marine Life]  
{Highlighting}  
{Shaded}
```

#### Processes:

- **Photosynthesis:** CO<sub>2</sub> absorption by plants
- **Respiration:** CO<sub>2</sub> release by organisms
- **Decomposition:** Carbon return to atmosphere
- **Ocean exchange:** CO<sub>2</sub> dissolution in seawater

#### Mnemonic

"Plants Breathe, Die, Ocean" (PBDO)

### 0.0.18 OR

### 0.0.19 Draw and explain the hydrologic cycle

#### Solution

Hydrologic cycle is the continuous movement of water through atmosphere, land, and oceans.

#### Mermaid Diagram (Code)

```
{Shaded}  
{Highlighting} []  
graph LR  
    A[Ocean] --> B[Evaporation]  
    B --> C[Water Vapor]  
    C --> D[Condensation]  
    D --> E[Clouds]  
    E --> F[Precipitation]  
    F --> G[Surface Runoff]  
    F --> H[Infiltration]  
    G --> A  
    H --> I[Groundwater]  
    I --> A  
{Highlighting}  
{Shaded}
```

#### Processes:

- **Evaporation:** Water to vapor conversion

- **Condensation:** Vapor to liquid conversion
- **Precipitation:** Rain, snow formation
- **Infiltration:** Groundwater recharge

### Mnemonic

“Every Cloud Produces Rain” (ECPR)

## Question 2(d) [4 marks]

0.0.20 Enlist equipments used to control air pollution and explain any one.

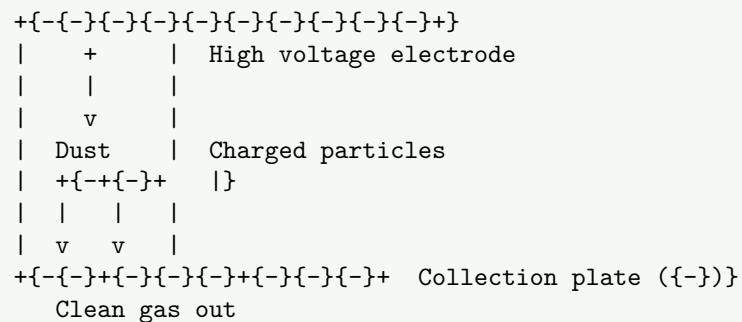
### Solution

Air pollution control equipment removes pollutants from industrial emissions.

#### Equipment List:

- **Cyclone separators:** Particulate removal
- **Electrostatic precipitators:** Fine particle collection
- **Bag filters:** Fabric filtration
- **Scrubbers:** Gas absorption

#### Electrostatic Precipitator:



- **Charging:** Particles acquire electric charge
- **Collection:** Charged particles attracted to plates
- **Efficiency:** 99% removal of fine particles

### Mnemonic

“Charge Collect Clean” (CCC)

0.0.21 OR

0.0.22 Enlist the types of environmental pollution and give the effects of noise pollution

### Solution

#### Environmental pollution types:

- **Air pollution:** Atmospheric contamination
- **Water pollution:** Aquatic contamination
- **Soil pollution:** Land contamination
- **Noise pollution:** Sound contamination

#### Noise Pollution Effects:

- **Health effects:** Hearing loss, stress, hypertension
- **Psychological effects:** Irritation, sleep disturbance
- **Performance effects:** Reduced concentration, productivity
- **Communication effects:** Speech interference

Effect Type	Symptoms	Impact
Physical	Hearing damage	Permanent loss
Mental	Stress, anxiety	Health issues
Social	Communication problems	Relationship strain

### Mnemonic

“Air Water Soil Sound” (AWSS)

### Question 3(a) [3 marks]

0.0.23 What is e-waste? Give effects of e-waste on environment and humans.

### Solution

**E-waste** (Electronic waste) consists of discarded electrical and electronic devices containing hazardous materials.

#### Environmental Effects:

- **Soil contamination:** Heavy metals leaching
- **Water pollution:** Toxic chemical runoff
- **Air pollution:** Burning releases toxic fumes

#### Human Effects:

- **Health hazards:** Lead, mercury poisoning
- **Respiratory problems:** Toxic gas inhalation
- **Skin disorders:** Direct contact with chemicals

Component	Hazard	Impact
Lead	Neurotoxin	Brain damage
Mercury	Toxic metal	Kidney damage
Cadmium	Carcinogen	Cancer risk

### Mnemonic

“Electronic Equipment Endangers Everyone” (E4)

0.0.24 OR

0.0.25 What is plastic waste? Give effects of plastic waste.

### Solution

**Plastic waste** consists of discarded plastic materials that persist in environment due to non-biodegradable nature.

#### Effects:

- **Marine pollution:** Ocean plastic accumulation
- **Wildlife impact:** Entanglement, ingestion by animals
- **Soil degradation:** Reduced fertility and water infiltration
- **Human health:** Microplastics in food chain

#### Categories:

- **Single-use plastics:** Bags, bottles, straws
- **Packaging waste:** Food containers, wrappings
- **Industrial plastic:** Manufacturing waste

### Mnemonic

“Plastic Persists, Problems Persist” (PPPP)

### Question 3(b) [3 marks]

0.0.26 Give main sources of solid waste.

#### Solution

**Solid waste** originates from various human activities and natural processes.

##### Sources:

- **Residential:** Household garbage, food waste
- **Commercial:** Office waste, packaging materials
- **Industrial:** Manufacturing waste, chemicals
- **Agricultural:** Crop residues, animal waste
- **Municipal:** Street sweeping, park maintenance

Source	Waste Type	Management
Domestic	Organic, Plastic	Collection
Industrial	Hazardous, Non-hazardous	Treatment
Agricultural	Biodegradable	Composting

#### Mnemonic

“Residential Commercial Industrial Agricultural Municipal” (RCIAM)

0.0.27 OR

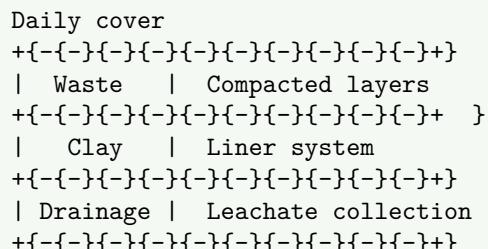
0.0.28 Enlist various methods of solid waste disposal and explain any one.

#### Solution

##### Disposal Methods:

- **Landfilling:** Controlled waste burial
- **Incineration:** Waste burning with energy recovery
- **Composting:** Organic waste decomposition
- **Recycling:** Material recovery and reuse

##### Sanitary Landfill:



- **Design:** Engineered system with liners
- **Operation:** Daily cover, compaction
- **Environmental protection:** Leachate and gas control

#### Mnemonic

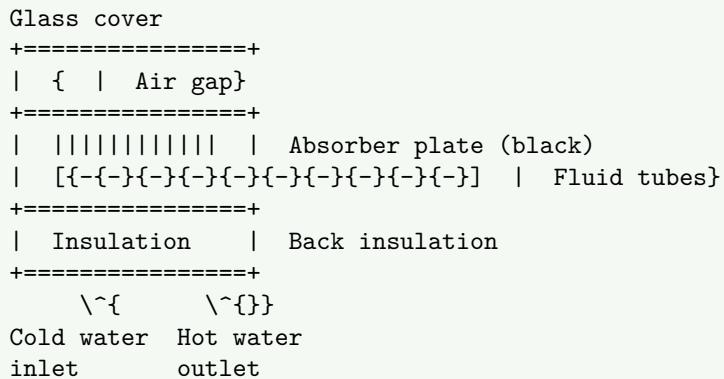
“Land Incinerate Compost Recycle” (LICR)

### Question 3(c) [4 marks]

0.0.29 Explain the working of Liquid Flat Plate Collector with a neat sketch.

#### Solution

**Liquid Flat Plate Collector** converts solar radiation into thermal energy for heating water.



#### Working:

- **Solar absorption:** Black absorber plate captures solar energy
- **Heat transfer:** Absorbed heat transfers to flowing liquid
- **Circulation:** Heated liquid rises, cool liquid enters
- **Insulation:** Minimizes heat losses

#### Components:

- **Transparent cover:** Reduces convection losses
- **Absorber plate:** Maximum solar absorption
- **Heat transfer fluid:** Water or antifreeze solution

#### Mnemonic

“Solar Absorption Creates Heat Transfer” (SACHT)

0.0.30 OR

0.0.31 Write short note on solar pond

#### Solution

**Solar pond** is a pool of saltwater that acts as both solar collector and thermal storage system.

#### Structure:

- **Upper zone:** Low salt concentration
- **Middle zone:** Increasing salt gradient
- **Lower zone:** High salt concentration

#### Working:

- **Density gradient:** Prevents convection mixing
- **Heat storage:** Bottom layer stores thermal energy
- **Temperature:** Can reach 70-85°C at bottom

#### Applications:

- **Power generation:** Steam production
- **Industrial heating:** Process heat supply
- **Desalination:** Water purification

#### Mnemonic

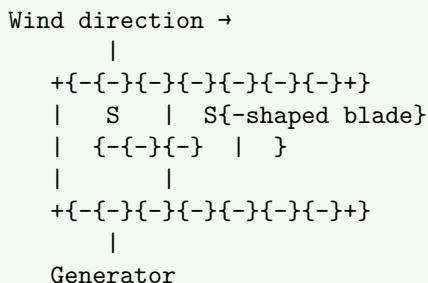
“Salt Stores Solar Thermal” (SSST)

### Question 3(d) [4 marks]

0.0.32 Explain Savonius wind mill with a neat sketch.

#### Solution

**Savonius wind turbine** is a vertical axis wind turbine with S-shaped rotor blades.



#### Working:

- **Drag principle:** Wind creates differential drag on blades
- **Rotation:** S-shape causes continuous rotation
- **Self-starting:** Starts at low wind speeds
- **Vertical axis:** Independent of wind direction

#### Advantages:

- **Simple design:** Low maintenance requirements
- **Low noise:** Quiet operation
- **All wind directions:** Omnidirectional capability

#### Disadvantages:

- **Lower efficiency:** 20-30% compared to HAWT
- **Space requirement:** Larger area needed

#### Mnemonic

“S-Shape Starts Slowly” (SSS)

0.0.33 OR

0.0.34 Give the comparison between Horizontal Axis and Vertical Axis wind mills.

#### Solution

Wind turbines are classified based on rotor axis orientation.

#### Comparison Table:

Parameter	Horizontal Axis (HAWT)	Vertical Axis (VAWT)
Efficiency	35-45%	20-30%
Wind direction	Must face wind	Any direction
Installation	Tower required	Ground level possible
Maintenance	Difficult access	Easy access
Noise	Higher	Lower
Cost	Higher	Lower

#### HAWT Features:

- **Upwind design:** Rotor faces wind
- **Pitch control:** Blade angle adjustment
- **Yaw system:** Wind direction tracking

#### VAWT Features:

- **Omnidirectional:** No wind tracking needed
- **Ground installation:** Easier maintenance
- **Lower wind speeds:** Better performance

## Mnemonic

“Horizontal High, Vertical Versatile” (HHVV)

### Question 4(a) [3 marks]

0.0.35 Give effects of climate change.

## Solution

Climate change causes widespread environmental and socio-economic impacts globally.

### Environmental Effects:

- **Temperature rise:** Global average increase
- **Sea level rise:** Thermal expansion and ice melting
- **Weather extremes:** Intense storms, droughts, floods
- **Ecosystem shifts:** Species migration and extinction

### Socio-economic Effects:

- **Agricultural impact:** Crop yield changes
- **Water resources:** Availability and quality issues
- **Human health:** Heat stress, disease spread
- **Economic losses:** Infrastructure damage

Impact Category	Examples	Severity
Environmental	Melting glaciers	High
Agricultural	Crop failure	Medium
Health	Heat waves	High

## Mnemonic

“Temperature Sea Weather Ecosystem” (TSWE)

0.0.36 OR

0.0.37 Write a short note on Green House gases.

## Solution

Greenhouse gases trap heat in Earth's atmosphere, causing global warming through greenhouse effect.

### Major Greenhouse Gases:

- **Carbon dioxide (CO<sub>2</sub>):** 76% of emissions
- **Methane (CH<sub>4</sub>):** 16% of emissions
- **Nitrous oxide (N<sub>2</sub>O):** 6% of emissions
- **Fluorinated gases:** 2% of emissions

### Sources:

- **CO<sub>2</sub>:** Fossil fuel burning, deforestation
- **CH<sub>4</sub>:** Agriculture, landfills, livestock
- **N<sub>2</sub>O:** Fertilizers, fossil fuel combustion

### Global Warming Potential:

- **CO<sub>2</sub>:** Reference (GWP = 1)
- **CH<sub>4</sub>:** 25 times CO<sub>2</sub>
- **N<sub>2</sub>O:** 298 times CO<sub>2</sub>

## Mnemonic

“Carbon Methane Nitrous Fluorine” (CMNF)

## Question 4(b) [4 marks]

0.0.38 Explain climate change Management.

### Solution

**Climate change management** involves strategies to reduce greenhouse gas emissions and adapt to climate impacts.

#### Mitigation Strategies:

- **Renewable energy:** Solar, wind, hydroelectric power
- **Energy efficiency:** Improved building designs, LED lighting
- **Carbon sequestration:** Forest conservation, tree planting
- **Sustainable transport:** Electric vehicles, public transport

#### Adaptation Strategies:

- **Infrastructure resilience:** Flood defenses, drought-resistant crops
- **Water management:** Rainwater harvesting, efficient irrigation
- **Coastal protection:** Sea walls, mangrove restoration
- **Emergency preparedness:** Early warning systems

#### Policy Measures:

- **Carbon pricing:** Tax on emissions
- **Renewable energy targets:** Clean energy goals
- **Building codes:** Energy efficiency standards

### Mnemonic

“Mitigation Adaptation Policy” (MAP)

0.0.39 OR

0.0.40 Give effects of ozone layer depletion.

### Solution

**Ozone layer depletion** reduces stratospheric ozone, allowing harmful UV radiation to reach Earth.

#### Effects on Humans:

- **Skin cancer:** Increased UV-B radiation exposure
- **Eye cataracts:** UV damage to eye lens
- **Immune suppression:** Weakened immune system
- **Premature aging:** Skin damage acceleration

#### Effects on Environment:

- **Crop damage:** Reduced agricultural productivity
- **Marine ecosystem:** Phytoplankton reduction
- **Material degradation:** Plastic and rubber damage
- **Climate change:** Ozone as greenhouse gas

UV Type	Wavelength	Effect
UV-A	320-400 nm	Skin aging
UV-B	280-320 nm	Sunburn, cancer
UV-C	200-280 nm	Blocked by ozone

### Mnemonic

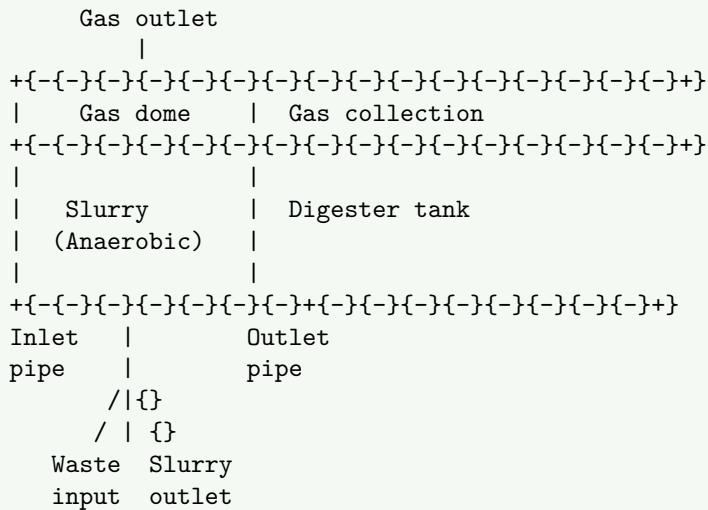
“Skin Eyes Immunity Climate” (SEIC)

## Question 4(c) [7 marks]

0.0.41 Explain biogas plant with sketch.

### Solution

Biogas plant produces methane-rich gas through anaerobic digestion of organic waste.



#### Components:

- **Digester tank:** Anaerobic fermentation chamber
- **Gas dome:** Biogas collection and storage
- **Inlet pipe:** Waste material feeding
- **Outlet pipe:** Digested slurry removal

#### Process:

- **Hydrolysis:** Complex organics break down
- **Acidogenesis:** Acid-forming bacteria action
- **Methanogenesis:** Methane-producing bacteria
- **Gas production:** 50-70% methane, 30-40% CO

#### Operating Conditions:

- **Temperature:** 30-40°C optimal
- **pH:** 6.8-7.2 range
- **Retention time:** 15-30 days
- **C:N ratio:** 20-30:1 optimal

#### Applications:

- **Cooking fuel:** Household energy needs
- **Lighting:** Gas lamp illumination
- **Electricity:** Generator power
- **Fertilizer:** Nutrient-rich slurry

#### Advantages:

- **Renewable energy:** Sustainable fuel source
- **Waste management:** Organic waste utilization
- **Environmental benefits:** Reduced methane emissions
- **Economic benefits:** Cost savings on fuel

### Mnemonic

“Biogas Benefits: Renewable Waste Environment Economy” (BRWEE)

## Question 5(a) [4 marks]

0.0.42 Write short note on global warming.

### Solution

**Global warming** refers to long-term increase in Earth's average surface temperature due to human activities.

#### Causes:

- **Greenhouse gases:** CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O emissions
- **Deforestation:** Reduced carbon absorption
- **Industrial activities:** Fossil fuel combustion
- **Transportation:** Vehicle emissions

#### Effects:

- **Temperature rise:** 1.1°C since pre-industrial times
- **Ice melting:** Arctic sea ice, glaciers shrinking
- **Sea level rise:** Coastal flooding threat
- **Weather changes:** Extreme events frequency

#### Evidence:

- **Temperature records:** Warmest years in recent decades
- **Ice core data:** Historical CO<sub>2</sub> levels
- **Satellite measurements:** Global temperature monitoring

#### Solutions:

- **Renewable energy:** Clean power sources
- **Energy efficiency:** Reduced consumption
- **Carbon capture:** Technology development
- **International cooperation:** Paris Agreement

### Mnemonic

"Greenhouse Gases Generate Global Change" (GGGC)

## Question 5(b) [4 marks]

0.0.43 Explain 5R concept.

### Solution

**5R concept** is waste management hierarchy for sustainable resource utilization.

#### Mermaid Diagram (Code)

```
{Shaded}
{Highlighting} []
graph TD
    A[5R Hierarchy] --> B[Refuse]
    A --> C[Reduce]
    A --> D[Reuse]
    A --> E[Repurpose]
    A --> F[Recycle]
{Highlighting}
{Shaded}
```

#### The 5 R's:

##### 1. Refuse:

- **Avoid unnecessary items:** Say no to single-use products
- **Examples:** Plastic bags, straws, excessive packaging

##### 2. Reduce:

- **Minimize consumption:** Use less resources
- **Examples:** Energy conservation, water saving

##### 3. Reuse:

- **Multiple use:** Extend product life
- **Examples:** Glass jars as containers, paper both sides

**4. Repurpose:**

- **Creative reuse:** New function for old items
- **Examples:** Tire planters, bottle bird feeders

**5. Recycle:**

- **Material recovery:** Process into new products
- **Examples:** Paper, plastic, metal recycling

**Benefits:**

- **Waste reduction:** Less landfill burden
- **Resource conservation:** Natural resource preservation
- **Cost savings:** Economic benefits
- **Environmental protection:** Pollution reduction

**Mnemonic**

“Refuse Reduce Reuse Repurpose Recycle” (R5)

**Question 5(c) [3 marks]****0.0.44 Explain the benefits of Green building.****Solution**

**Green building** incorporates sustainable design and construction practices for environmental and human benefits.

**Environmental Benefits:**

- **Energy efficiency:** Reduced power consumption
- **Water conservation:** Efficient water systems
- **Waste reduction:** Construction and operational waste minimization

**Economic Benefits:**

- **Operating cost savings:** Lower utility bills
- **Increased property value:** Market premium
- **Tax incentives:** Government rebates

**Health Benefits:**

- **Indoor air quality:** Better ventilation systems
- **Natural lighting:** Improved occupant comfort
- **Toxic material reduction:** Healthier environment

Benefit Type	Examples	Impact
Environmental	Energy saving	30-50% reduction
Economic	Cost savings	20% operating costs
Health	Air quality	Productivity increase

**Mnemonic**

“Green Buildings Give Environmental Economic Health” (GBEEH)

**Question 5(d) [3 marks]****0.0.45 Enlist various Acts related to environment in India and explain any one.****Solution****Environmental Acts in India:**

- **Water (Prevention and Control of Pollution) Act, 1974**
- **Air (Prevention and Control of Pollution) Act, 1981**
- **Environment Protection Act, 1986**
- **Wildlife Protection Act, 1972**
- **Forest (Conservation) Act, 1980**

- **Biodiversity Act, 2002**

**Environment Protection Act, 1986: Objectives:**

- **Comprehensive framework:** Overall environmental protection
- **Pollution prevention:** Air, water, soil contamination control
- **Standard setting:** Environmental quality standards
- **Enforcement:** Penalties for violations

**Powers:**

- **Central government authority:** Environmental regulations
- **Inspection rights:** Industrial facilities monitoring
- **Closure orders:** Non-compliant industries
- **Emergency measures:** Environmental hazards response

**Significance:**

- **Umbrella legislation:** Covers all environmental aspects
- **Post-Bhopal disaster:** Response to industrial accidents

**Mnemonic**

“Water Air Environment Wildlife Forest Biodiversity” (WAEWFB)