

Paper IV- Environmental Microbiology

Question Bank

Unit I

Q.1 Choose the correct alternative.

(Each carries 1 mark)

1. In an ecosystem, the energy flow is

- a) **Always unidirectional**
- b) Always bidirectional
- c) In any direction
- d) Always down directional

2. The following type of food chain is

Dead animal → blowfly maggot → maggot → frog → snake

- a) **Detritus food chain**
- b) Decomposer food chain
- c) Predator food chain
- d) Grazing food chain

3. According to ecological pyramid for energy, maximum energy is required by

- a) Secondary consumer
- b) Decomposer
- c) Primary consumer
- d) **Primary producer**

4. "The pyramid of energy is always upright" states that

- a) **The energy conversion efficiency of herbivores is better than carnivores**
- b) The energy conversion efficiency of carnivores is better than herbivores
- c) Producers have the lowest energy conversion efficiency
- d) Energy conversion efficiency is the same in all trophic levels

5. A wide variety of living organisms is called

- a) **Biodiversity**
- b) Population
- c) Habitat
- d) Diversity

6. A pond is

- a) A biome
- b) A community of plants and animals
- c) **A natural ecosystem**
- d) None of the above

7. Ecosystems are

- a) Always open
- b) Always closed
- c) **Both open and closed depending upon the community**
- d) Both open and closed depending upon biomass

8. The renewable exhaustible natural energy resource of the following is

- a) Coal
- b) Petroleum



- c) Kerosene
- d) **Biomass**

9. Removing decomposers from the ecosystem will cause

- a) Energy cycle to stop
- b) **Mineral cycle to stop**
- c) Consumers unable to absorb solar energy
- d) Increases in the rate of decomposition of minerals

10. Biodiesel and Bioethanol are examples of

- a) Non-renewable source of energy
- b) **Renewable source of energy**
- c) Nuclear power source
- d) All of these

Q.2 Fill in the blanks.

(Each carries 1 mark)

1. The term 'ecosystem' was coined by **Arthur Tansley**.
2. The organisms that help in decomposing the organic matter are known as **decomposers**.
3. **Heterotrophs** are the organisms that derive their energy by eating live or dead organic matter.
4. **Abiotic factors** are non-living chemical and physical parts of the environment that affect living organisms and the functioning of ecosystems.
5. **An ecosystem** is a structural and functional unit of ecology.
6. **Sundarban** sanctuary of West Bengal is reserved for tigers.
7. IUCN stands for **International Union for Conservation of Nature**.
8. The **lithosphere** consists of upper mantle and crust.
9. Ecosystems containing interconnected food chains are known as **food webs**.
10. **Consumers** are organisms that eat other living organisms.

Q.3 Answer in one sentence.

(Each carry 1 mark)

1. Define habitat.

Ans: Habitat is the area or natural environment in which an organism or population normally lives.

2. Define producers.

Ans: Organisms that produce their own food from simple inorganic substances such as water, sunlight and carbon dioxide are called as producers.

3. Give any two examples of endangered species.

Ans: Amur tiger, Red panda and Asiatic elephant

4. State the significance of 'Red' indication in the IUCN red list.

Ans: 'Red' indicate in the IUCN red list to the taxa with the highest risk of extinction.

5. Define sustainable development.

Ans: Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs

6. Define community.

Ans: Community is a group or association of populations of two or more different species occupying the same geographical area at the same time.

7. Define homeostasis.

Ans: Homeostasis is the ability to maintain internal stability in an organism in response to the environmental changes.

8. Define microbial ecology.

Ans: microbial ecology is the study of interrelationship between different microorganisms, plants and animals and their environment.

9. Define ecological pyramid

Ans: Ecological pyramid is a graphical representation showing the relationship between different organisms in an ecosystem.

10. Give any two examples of sustainable development.

Ans: Solar energy, crop rotation, green house and sustainable forestry.

Q.4 Short answer questions.

(Each carry 4 marks)

1. Describe in brief concept of habitat in biosphere.
2. Explain food chain.
3. Explain food web.
4. Comment briefly on homeostasis.
5. Explain the interaction between environment and biota.
6. Explain the role of bacterial technology in achieving sustainable development.
7. Comment briefly on ecological pyramid of energy.
8. Comment briefly on ecological pyramid of biomass.
9. Comment briefly on ecological pyramid of number of organisms.
10. Explain the importance of consumers and producers in food chain.

Q.5 Long answer questions.

(Each carry 8 marks)

1. Explain ecosystem and its management.
2. Describe renewable sources of energy and fuel using microorganisms.
3. Describe the sustainable development and need of sustainable development
4. Explain biodiversity and its importance.
5. Illustrate about the pollution control.
6. Describe the sustainable development and the role of bacterial technology in achieving sustainable development.
7. Explain the concept and techniques for improvement and restoration of barren land.
8. Explain the interaction between environment and biota.
9. Describe biodiversity and its conservation.
10. Explain sustainable development of ecosystem.



Unit II – Nitrogen cycle

Q.1 Choose the correct alternative.

(Each carry 1 mark)

1. The non-denitrifying bacteria of the following is

- a) *Pseudomonas aeruginosa*
- b) *Thiobacillus*
- c) *Thiobacillus denitrificans*
- d) ***Bacillus ramosus***

2. Nitrogen fixation is the conversion of

- (a) N_2 to N
- (b) N_2 to NH_3**
- (c) N_2 to NO_3^-
- (d) N_2 to urea

3. Important enzymes involved in nitrogen fixation are

- (a) Nitrogenase and hydrogenase**
- (b) Nitrogenase and hexokinase
- (c) Nitrogenase and peptidase
- (d) Nitrogenase and hydrolyase

4. The number of molecules of ATP required to fix one molecule of nitrogen are

- (a) 12
- (b) 20
- (c) 6
- (d) 16**

5. Ammonification is the formation of

- (a) Ammonia from nitrates by decomposers
- (b) Ammonia from nitrogen
- (c) Ammonia from amino acids**
- (d) Ammonia from nitrates by nitrogen fixers

6. Conversion of nitrates to nitrogen is called

- (a) Ammonification
- (b) Nitrification
- (c) Nitrogen fixation
- (d) Denitrification**

7. The following bacteria are responsible for conversion of nitrites to nitrates is called

- (a) Nitrosococcus
- (b) Clostridium
- (c) Nitrobacter**
- (d) Nitrosomonas

8. Conversion of ammonia to nitrite and then to nitrates is called

- (a) Ammonification
- (b) Denitrification
- (c) Assimilation

(d) Nitrification

9. The following bacteria are ammonia-oxidizing bacteria

- a) ***Nitrospina gracilis***
- b) *Nitrosomonas europaea*
- c) *Nitrosococcus oceanus*
- d) *Nitrosovibrio tenuis*

10. Component II of the nitrogenase enzyme complex does not include the following feature

- a) Contains sulphur
- b) Component II is nitrogenase reductase
- c) **Component II is called the MoFe protein**
- d) Not activate without component I

Q. 2 Fill in the blanks.

(Each carry 1 mark)

1. **Denitrifying** bacteria in the soil can break down the ammonia into the gaseous form of nitrogen which is not available for use by plants and animals.
2. **Nitrosification** is the oxidation of nitrogen to nitrite.
3. Azotobacter is an example of **non-symbiotic** nitrogen fixing bacteria.
4. The term nitrification was discovered by **Sergei Winogradsky**.
5. Release of ammonia from organic nitrogenous compounds is termed as **ammonification**.
6. Plants absorb **nitrogen** in the form of ammonia, nitrates and nitrites.
7. Fixation is the conversion of atmospheric N₂ to **organic N**.
8. **Nitrification** in the nitrogen cycle was discovered by Sergei Winogradsky.
9. Nitrosomonas bacteria convert nitrogen gas to **nitrite**.
10. Assimilation is the conversion of **inorganic N** to organic N.

Q.3 Answer in one sentence.

(Each carry 1 mark)

1. Name the co-factor required for the activity of nitrogenase.
Ans: Molybdenum is the co-factor required for the activity of nitrogenase.
2. Give any two examples of non-symbiotic nitrogen fixing bacteria.
Ans: Azotobacter and Azospirillum are the examples of non-symbiotic nitrogen fixing bacteria.
3. Name the enzyme which plays important role in nitrogen fixation.
Ans: Nitrogenase play important role in nitrogen cycle.
4. Give any two examples of symbiotic nitrogen fixing bacteria.
Ans: Rhizobium meliloti, Rhizobium trifolii and Rhizobium leguminosarum are the examples of symbiotic nitrogen fixing bacteria.
5. Define ammonification.
Ans: Release of ammonia from organic nitrogenous compounds is termed as ammonification.
6. Name any two bacteria involved in the process of nitrification.
Ans: Nitrosomonas, Nitrosococcus and Nitrobacter are the bacteria involved in the process of nitrification.
7. Define non-symbiotic nitrogen fixers.
Ans: Non-symbiotic nitrogen fixers which fix molecular nitrogen to cellular nitrogen nitrogen independently of other living organisms.
8. Define denitrification.
Ans: Denitrification is the process of reducing nitrate and nitrite to highly oxidized form of nitrogen available for consumption by many groups of microorganisms.
9. Define nitrosification.
Ans: The oxidation of ammonia to nitrite is known as nitrosification.
10. Name any two examples of denitrifying bacteria.

Ans: Paracoccus denitrificans, Thiobacillus denitrificans and Pseudomonas spp. are the examples of denitrifying bacteria.

Q.4 Short answer questions.

(Each carry 4 marks)

1. Give an account on term Ammonification.
2. Explain the process of nitrification.
3. Explain the structure of nitrogenase enzyme.
4. Explain the process of denitrification.
5. Explain symbiotic fixers in detail.
6. Explain mechanism of nitrogen fixation.
7. Explain the role of microorganisms in nitrogen cycle.
8. Explain biochemistry of nitrogen cycle.
9. Explain non-symbiotic fixers.
10. Explain the structure of nitrogenase enzyme.

Q.5 Long answer questions.

(Each carry 8 marks)

1. Describe in brief process involved in the nitrogen cycle.
2. Explain in detail nitrogen cycle.
3. Explain the biochemistry of nitrate reduction.
4. Give the mechanism of nitrogenase enzyme in nitrogen cycle.
5. Give an account on nitrification and denitrification.
6. Explain the biochemistry and microbiology of nitrogen cycle.
7. Describe non-symbiotic nitrogen fixation with suitable example.
8. Describe symbiotic nitrogen fixation with suitable example.
9. Explain energy input/output ratio of nitrogen in crop production.
10. Explain the structure and characteristics of nitrogenase in nitrogen cycle.

Unit -III

Q.1 Choose the correct alternative.

(Each carry 1 mark)

1. Which one of the following is a major constituent of biological membranes, nucleic acids, and cellular energy transfer systems?
 - a) Potassium
 - b) Phosphorous**
 - c) Selenium
 - d) Cobalt
2. Which of the following component is used to make shells, bones, and teeth by animals?
 - a) Phosphorous**
 - b) Sodium
 - c) Gallium
 - d) Argon
3. Which of the following is the natural reservoir of phosphorous?
 - a) Atmospheric gases
 - b) Rocks**
 - c) Water
 - d) Dead organisms
4. Which element is not released during respiration in the atmosphere?
 - a) Nitrogen

- b) Cobalt
- c) Carbon
- d) Phosphorous**

5. Which one of the following is the simplified sequence of phosphorus cycling in a terrestrial ecosystem?

- a) Soil - Producers - Rock minerals - Consumers - Decomposers
- b) Rock minerals - Soil - Producers - Consumers - Decomposers**
- c) Rock minerals - Decomposers - Producers - Consumers
- d) Decomposers - Rock minerals - Consumers - Producers

6. How do herbivores and other animals obtain phosphorous?

- a) Soil
- b) Rocks
- c) Water
- d) Plants**

7. Which of the following is a major constituent of DNA and RNA?

- a) Calcium
- b) Cobalt
- c) Selenium
- d) Phosphorous**

8. Respiration and photosynthesis are central to this process

- a) Nitrogen cycle
- b) Phosphorous cycle
- c) Carbon cycle**
- d) Sulphur cycle

9. The source of carbon to plants in the carbon cycle is

- a) Fossil fuels
- b) Carbonate rocks
- c) Atmospheric carbon dioxide
- d) All of the above**

10. What Percent of Carbon is found dissolved in oceans out of total quantity of global Carbon?

- a) 50 Percent
- b) 71 Percent**
- c) 90 Percent
- d) 25 Percent

11. Name the Process by which carbon return to the atmosphere as CO₂.

- a) Calcareous Sediments
- b) Decayed Organism
- c) Respiration**
- d) Photosynthesis

Q. 2 Fill in the blanks.

(Each carry 1 mark)

1. The conversion of organic sulfur compounds to the inorganic compounds by microorganisms is termed as **mineralization** of sulfur.

2. Sulphates are reduced to hydrogen sulphide by *desulfotomaculum sp.*

- Anaerobic sulphate-reducing bacteria reduce of sulphates and sulphites to **hydrogen sulphide**.
- The conversion of sulphur to sulphates by enzyme *Thiobacillus thiooxidans*.
- Phospholipids** are compounds in which phosphate is combined with lipids.
- Cellulase** enzyme is responsible for degradation of cellulose to cellulobiose.
- Immobilization** is the microbial conversion of inorganic sulfur compounds to organic sulfur compounds.
- The role of bacteria in the carbon cycle is breakdown of **organic compounds**.
- Sedimentary cycle is another name of **phosphorous cycle**.
- CaCO₃** is the form of CO₂ that precipitate after dissolving in water.

Q.3 Answer in one sentence.

(Each carry 1 mark)

- Name any two phosphate solubilizing bacteria.

Ans: Pseudomonas sp. and Bacillus sp.

- Write the chemical formula for inorganic phosphate.

Ans: PO₄³⁻

- Other than nitrogen and potassium, which element is included in macronutrient category?

Ans: Phosphorous

- Name any two bacteria which can reduce sulphate to sulphide.

Ans: Desulfovibrio and Desulfotomaculum

- Name any two sulfur containing amino acids.

Ans: Cysteine and methionine

- State any two inorganic form of sulfur.

Ans: Elemental sulfur and sulfides

- Define carbon cycle.

Ans: the series of chemical, physical, geological and biological changes by which carbon moves through the earth's air, land, water and living organisms is called as carbon cycle.

- Name the enzyme that cleave phosphorous from more frequently encountered organic substrate.

Ans: Phosphatases

- Define respiration.

Ans: Respiration defined as the cellular mechanism that involves the complete combustion of glucose and oxygen into by-products like water, carbon dioxide and energy in the form of heat.

- Which form of carbon occur naturally in the atmosphere?

Ans: Carbon dioxide

Q.4 Short answer questions.

(Each carry 4 marks)

- Discuss occurrence and solubilization of phosphorus in nature.
- Explain deficiency and toxicity of selenium.
- Discuss occurrence and significance of selenium.
- Explain degradation of hemicellulose.
- Explain significance of phosphorous element in living system.
- Explain biochemistry of cellulose degradation.
- Explain significance of sulfur element in living system.
- Explain significance of carbon element in living system.
- Explain reactions involved in carbon cycle.
- Explain phosphate solubilizing bacteria.

Q.5 Long answer questions.

(Each carry 8 marks)

- Describe in brief carbon cycle.
- Explain generation and decay of detritus 'C' compounds.
- Explain phosphorous cycle and significance of 'P' compounds.

4. Describe selenium cycle with significance.
5. Explain biochemistry of sulfate reduction.
6. Explain role of carbonic anhydrase in carbon cycle.
7. Explain role of phosphobacter and mycorrhizae in crop production.
8. Describe cellulose degradation in the soil along with microorganisms.
9. Explain the reactions involved in sulfur cycle.
10. Explain anaerobic degradation of

Unit IV

Q.1 Choose the correct alternative.

(Each carry 1 mark)

1. The following is not a process of pesticide management
 - a) Waste management
 - b) Pollution control
 - c) Antibiotic development**
 - d) Manufacturing process
2. The hydrolysis of following compounds create environmental problems
 - a) Oxygen
 - b) Hydrogen
 - c) Nitrogen
 - d) Volatile compounds**
3. The following is a sustainable alternative for environment
 - a) Bio-leaching
 - b) Bio-remediation**
 - c) Bio-fortification
 - d) Immobilization
4. The following does not use microbial degradation method
 - a) Sewage sludge
 - b) Pesticide disposals
 - c) Polluted water
 - d) Redox potential**
5. The following fungi does not degrade DDT insecticide
 - a) *Aspergillus niger*
 - b) *Mucor alternans*
 - c) *Penicillium sp.*
 - d) *Bacillus cereus***
6. The following doesn't lead to toxicity of waste water
 - a) Magnesium**
 - b) Arsenic
 - c) Lead
 - d) Chromium
7. Mercury is eliminated from animal body in
 - a) 2 months

- b) 2 years
c) 18 months
d) **18 years**
8. The following is not used to clear-out heavy metal contamination in environment
a) Bacteria
b) Fungi
c) Algae
d) **H₂S**
9. Bacteria help in metal extraction by
a) **Oxidation of ore**
b) Reduction of ore
c) Assimilation
d) Accumulation
10. The following is not a method of heavy metal removal from water
a) Adsorption
b) Chemical precipitation
c) **Biogas**
d) Reverse osmosis

Q. 2 Fill in the blanks.

(Each carries 1 mark)

1. **Iron-oxidizing bacteria** are group of bacteria with the ability to exchange and accumulate divalent iron dissolved in water.
2. **Arsine gas** is the most toxic form of arsenic.
3. **Biotransformation** is the biochemical modification of one chemical compound or a mixture of chemical compounds.
4. **Lead** is a naturally occurring toxic metal found in the earth's crust.
5. In microbial methylation, methyl group is frequently transfer to mercury metal as **carbanium**.
6. Iron-oxidizing bacteria derive energy by oxidizing dissolved **ferrous iron**.
7. **Bioalkylation** is the mechanism by which alkyl group are transferred to metal or metalloid atom.
8. **Methyl mercury** is the toxic form of mercury.
9. **Tellurium** is the one of the rarest elements on earth which is available as a dark grey powder.
10. In E. coli, **methylcobalamine** is the major coenzyme that catalysed the transfer of methyl group to homocysteine, resulting in the formation of methionine.

Q.3 Answer in one sentence.

(Each carries 1 mark)

1. Define biotransformation.
Ans: The changes that occur to a substance by the actions of enzymes within an organism.
2. Define ecological succession.
Ans: Ecological succession is a series of changes that occur in an ecological community over time.
3. Name any two iron oxidizing bacteria.
Ans: Acidithiobacillus thiooxidans and Gallionella sp.
4. Name any two poisonous metal present in industrial effluents.
Ans: As, Zn, Ni and Cr
5. Define metalloids.
Ans: Metalloids are the elements that show the properties of both metals and non-metals.
6. Name any two bacteria that are responsible for degradation of pesticides.

Ans: Azotobacter sp. and Pseudomonas sp.

7. Give any two examples of chemical pesticides.

Ans: Carbamate and Organophosphate

8. Give any two examples of metalloids.

Ans: Arsenic and tellurium

9. Define acid mine drainage.

Ans: Acid mine drainage refers to the acidic water that forms when surface water and air are exposed to iron sulfide, typically pyrite, a solid waste byproduct of coal mining.

10. Define primary succession.

Ans: Primary succession is type of ecological succession in which plants and animals first colonize a barren, lifeless habitat.

Q.4 Short answer questions.

(Each carry 4 marks)

1. Explain acid mine drainage.
2. Explain types of biotransformation reaction.
3. Explain methylation of mercury.
4. Explain bioalkylation of arsenic.
5. Explain metalloids with suitable examples.
6. Explain hydrolysis reaction in biotransformation of pesticides.
7. Explain methylation of tellurium.
8. Explain microbiology of biotransformation of pesticides.
9. Explain degradation of DDT.
10. Explain types of ecological succession.

Q.5 Long answer questions.

(Each carry 8 marks)

1. Explain biotransformation of pesticides.
2. Describe in brief microbiology of metal and metalloid transformation.
3. Describe in brief biochemistry and microbiology of acid mine drainage.
4. Explain ecological succession.
5. Describe in brief biochemistry of metal and metalloid transformation.
6. Describe biotransformation of arsenic compound.
7. Comment briefly on iron oxidizing bacteria.
8. Describe biotransformation of lead.
9. Describe biotransformation



Unit V

Q.1 Choose the correct alternative.

(Each carry 1 mark)

1. Direct leaching benefits the following bacteria
 - a) **Autotrophic Bacteria**
 - b) Heterotrophic Bacteria
 - c) Chemotrophic Bacteria
 - d) Chemolithotrophic Bacteria

2. Bioleaching is done by
 - a) Protozoa
 - b) **Bacteria**
 - c) Algae
 - d) All of the above

3. Bioleaching of uranium carried out by _____
 - a) Direct Leaching Mechanism
 - b) **Indirect Leaching Mechanism**
 - c) Acid Leaching Mechanism
 - d) Alkali Leaching Mechanism

4. The following microbe is involved in uranium bioleaching
 - a) **Thiobacillus ferrooxidans**
 - b) E.coli
 - c) Streptococcus
 - d) A. Niger

5. The most common bacteria used for bioleaching is _____
 - a) Spirillum
 - b) Coccus
 - c) **Bacillus**
 - d) Streptococcus

6. What percentage of total world copper production does bioleaching of copper alone contribute?
 - a) 10%
 - b) 17%
 - c) **25%**
 - d) 33.3%

7. The following factors affect the rate of bioleaching
 - a) Particle size,
 - b) pH
 - c) Pulp density
 - d) **All of these**

8. The following bioleaching processes involve piling up of uncrushed waste rock
 - a) In Situ
 - b) **Dump Leaching**
 - c) Heap Leaching
 - d) Vat Leaching

9. The following is most suitable for bioleaching in a majority of the metals

- a) High pH
- b) Low pH**
- c) Neutral pH
- d) Very High pH

10. Microbial catalysed redox reaction leads to metal _____

- a) Mobilization**
- b) Immobilization
- c) Reduction
- d) Oxidation

11. The following is not included in the mechanism of bioleaching

- a) Acidolysis
- b) Complexolysis
- c) Redoxolysis
- d) Hydrolysis**

Q. 2 Fill in the blanks.

(Each carries 1 mark)

1. In 1947, *thiobacillus ferrooxidans* was identified as a part of the microbial community found in acid mine drainage.
2. **Sulfuric acid** is the main inorganic acid found in leaching process.
3. **Bacillus** is the most common bacteria used in bioleaching.
4. **Leaching** is the solubilization of one or more components of a complex solid by contact with a liquid phase.
5. **Bioheaps** are large amounts of low grade ore and effluents from extraction processes that contain trace amounts of minerals.
6. Biomining of copper needs conversion of water insoluble copper sulfides to **water soluble copper sulfates**.
7. **Lixiviant** is a liquid medium used in hydrometallurgy to selectively extract the desired metal from the ore.
8. In indirect leaching, iron acts as **electron carrier** in oxidation of pyrite.
9. During oxidation of sulfur compounds, **thiosulfate** is formed as intermediate.

Q.3 Answer in one sentence.

(Each carries 1 mark)

1. Define bioleaching.

Ans: Bioleaching is defined as the dissolution of metals from their mineral source by certain naturally occurring microorganisms.

2. Name any two bacteria involved in the process of metal bioleaching.

Ans: Thiobacillus ferrooxidans, Leptospirillum ferrooxidans are the example of bacteria involved in the process of metal bioleaching.

3. Define ore.

Ans: The naturally occurring material from which a mineral or minerals of economic value can be extracted is known as ore.

4. What is direct leaching?

Ans: Direct bioleaching uses minerals that are easily receptive to oxidation to create a direct enzymatic strike using the microorganisms to separate the metal and the ore.

5. Give any two applications of bioleaching.

Ans: Bioleaching can be used to extract metals from low concentration ores as gold that are too poor for other technologies.

It can be used to partially replace the extensive crushing and grinding that translates to prohibitive cost and energy consumption in a conventional process.

6. What is indirect bioleaching?

Ans: In the process indirect bioleaching, microbes are not in direct contact with minerals but leaching agent produced by these microbes which oxidize the ores.

7. Define biodeterioration.

Ans: Biodeterioration is defined as any undesirable change in the property of the material caused by the vital activities of organisms in that material.

8. Give any two examples of fungi that are responsible for biodeterioration of stone.

Ans: *Epicoccum nigrum* and *Drechslera* sp.

9. Give any two techniques used for bioleaching.

Ans: Heap leaching and slope leaching

10. Define biomimicry.

Ans: Biomimicry is the extraction of specific metals from their ores with the help of microorganisms.

Q.4 Short answer questions.

(Each carries 4 marks)

1. Explain the concept of biodeterioration.
2. Describe various application of bioleaching process.
3. Explain slope bioleaching.
4. Explain heap bioleaching.
5. Explain in situ bioleaching.

Q.5 Long answer questions.

(Each carries 8 marks)

1. Explain in detail biodeterioration of wood.
2. Discuss in brief bioleaching and method of bioleaching.
3. Describe in brief biodeterioration of pharmaceutical products.
4. Explain biodeterioration of metal along with one example.
5. Describe biodeterioration of stone work.
6. Discuss various technique of bioleaching.

