

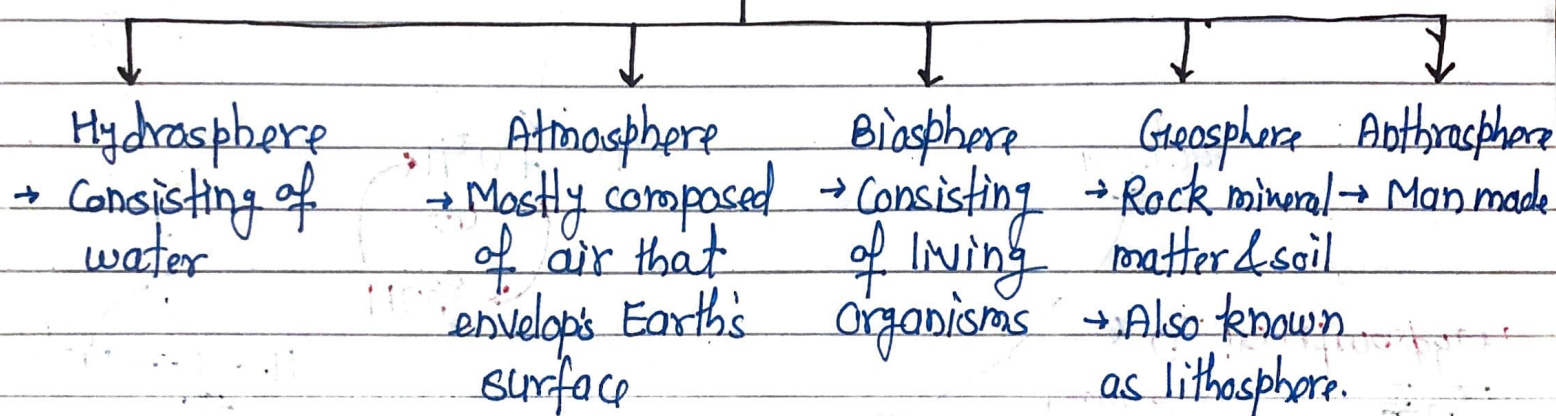
Industrial Chemicals and Environment

DSE-9 UPC 32177909

Environmental Chemistry: Environmental chemistry deals with the chemical processes, reactions and conditions that occur in Earth's environment.

Environment: surrounding

Components of Environment (also called as Earth's ecosystem)



→ Most important aspect of Earth system is the continuous exchange of matter and energy among five major environmental sphere.

→ Major factors in these exchanges consists of two great fluids that circulate in the Earth's system.

Two great fluids

- | | |
|--|---------------------------------------|
| <p>↓</p> <p>Surface water</p> <ul style="list-style-type: none">• Especially in the oceans and rivers.• Both these factors transport matter and energy. | <p>↓</p> <p>Air in the atmosphere</p> |
|--|---------------------------------------|

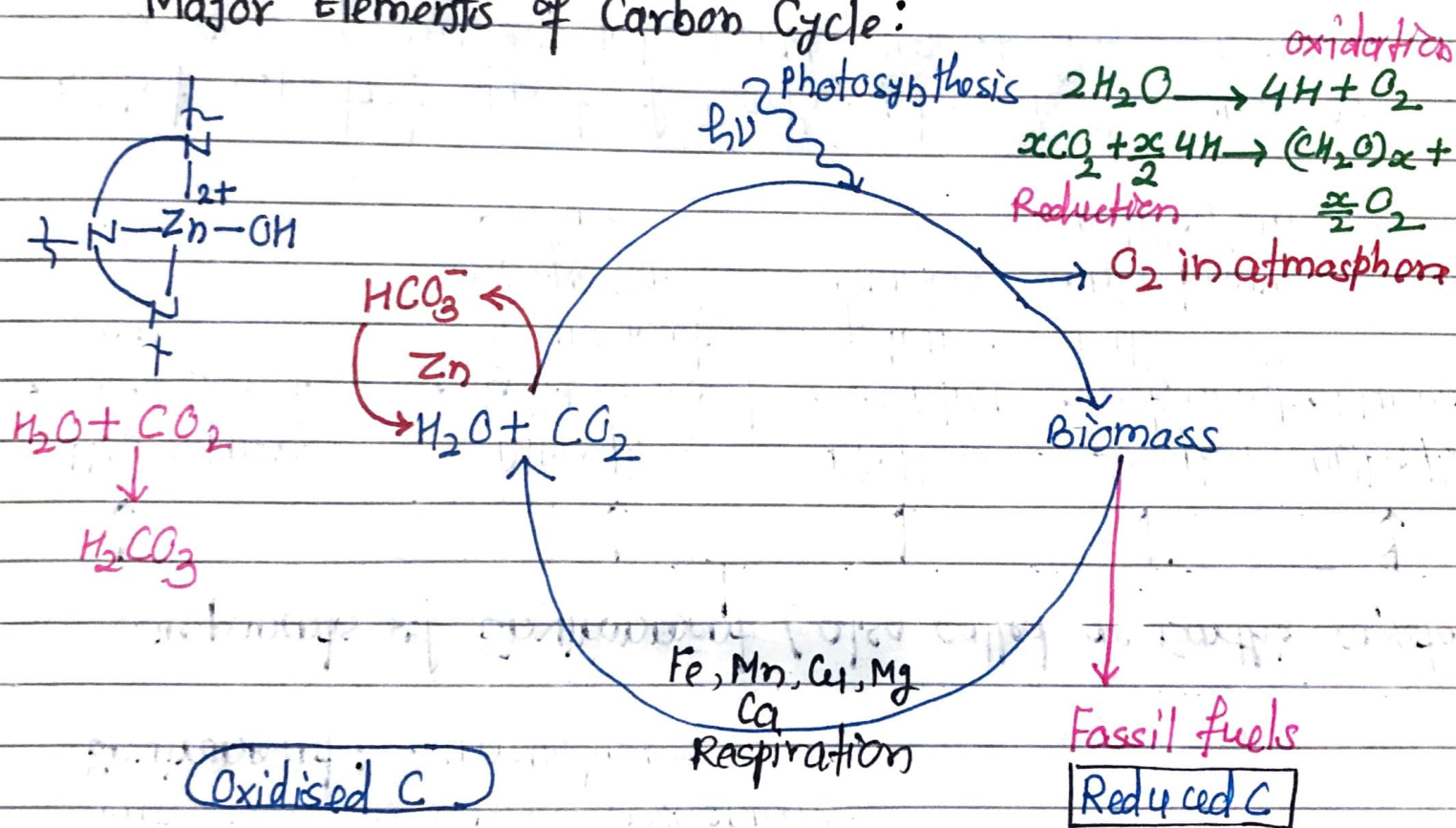
Pathways for Transport of Energy and Matter in Environment

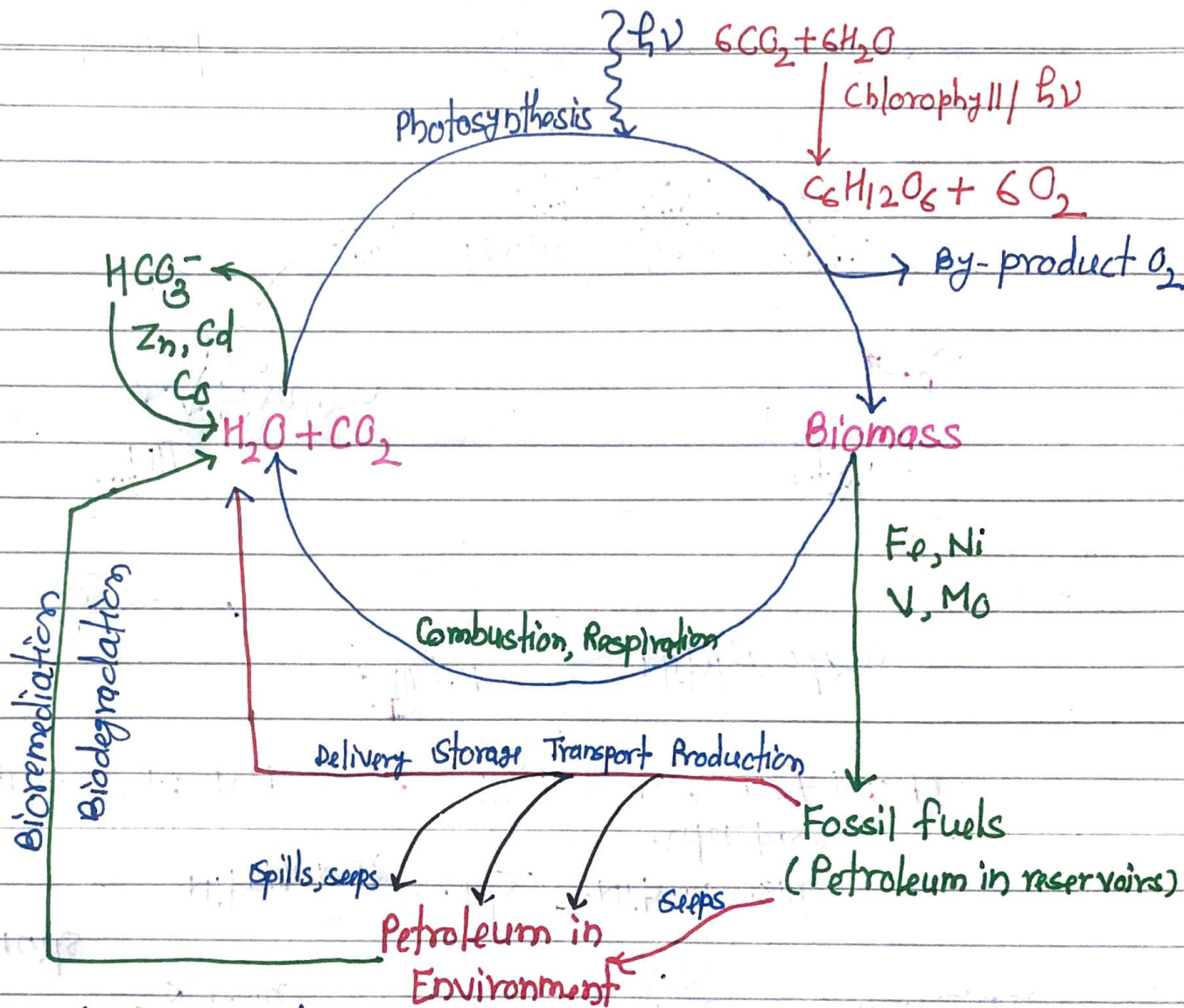
Two pathways

Via great fluids

Via Biogeochemical cycles
• cycles of key elements including essential elements.

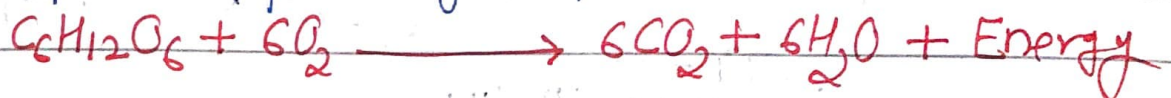
Major Elements of Carbon Cycle:





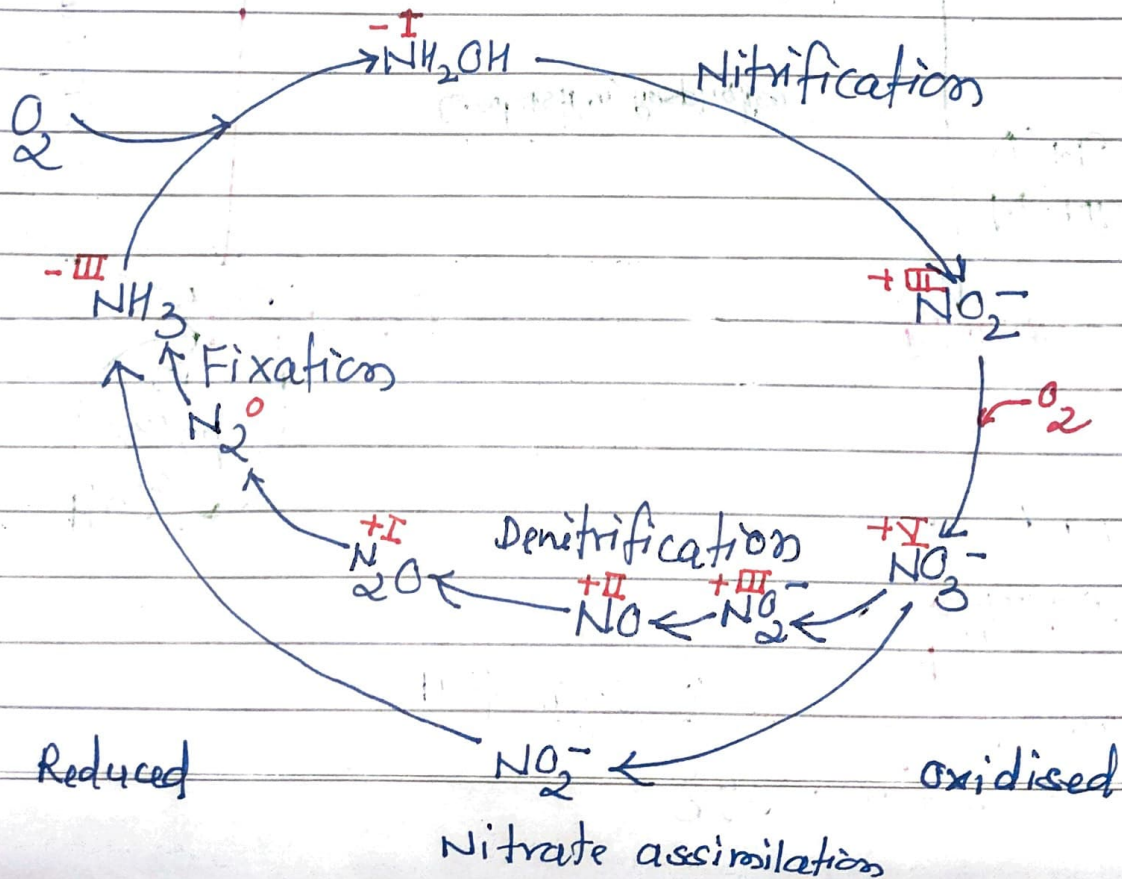
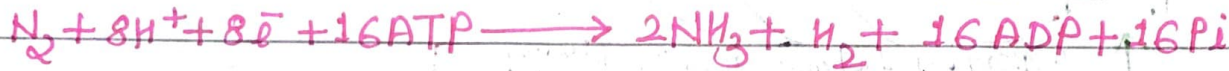
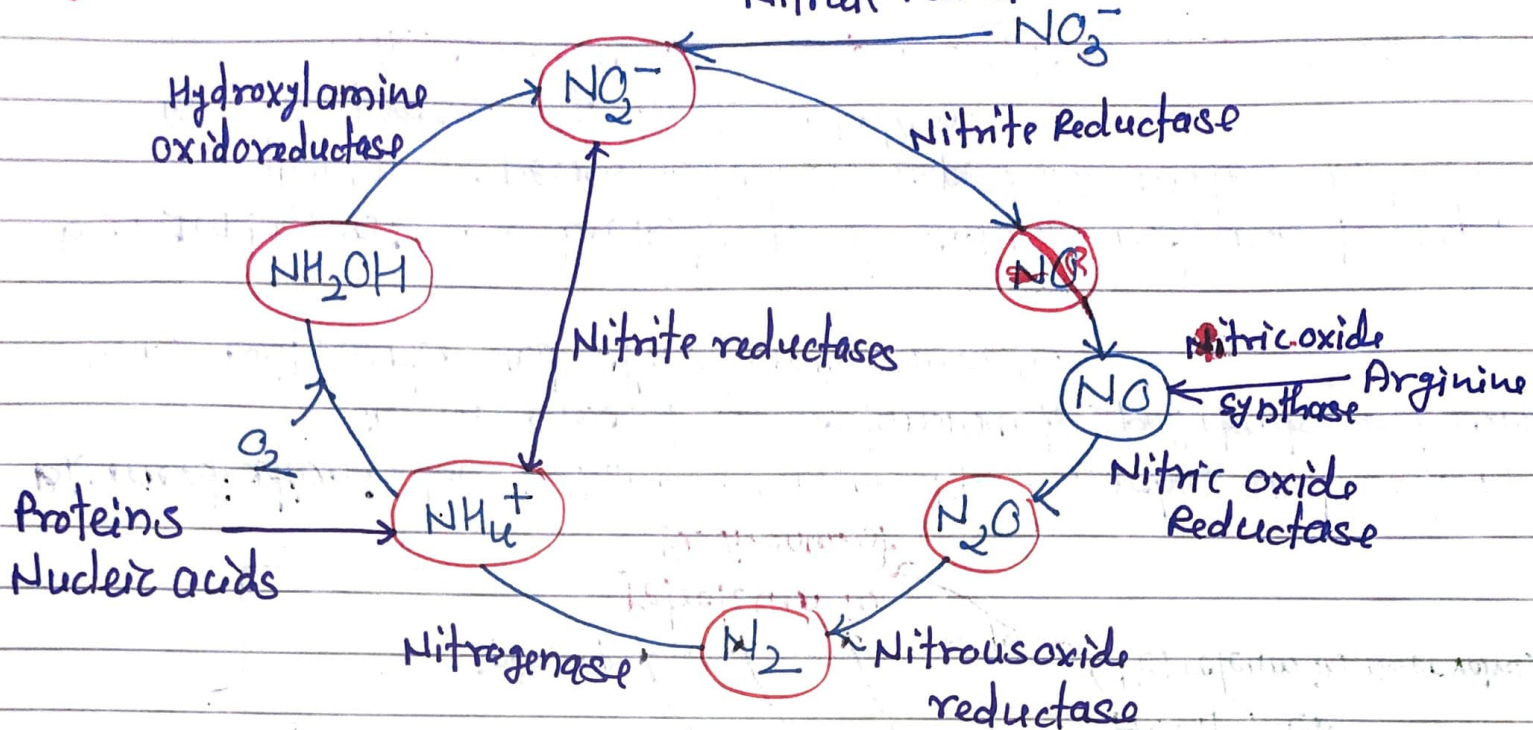
Bioremediation: Use of living organisms like microbes and bacteria in the removal of contaminants, pollutants and toxins from soil, water and other environments.

Biodegradation: The breakdown of organic molecules to simple inorganic species including especially water and CO_2 is the process of biodegradation.



Biological Nitrogen Cycle: Redox reaction

Enzymes involved = Fe, Cu & Mo enzymes. Nitrate reductase (Mo)



Nitrogen fixation: $N_2 + 8H^+ + 8e^- + 16ATP \rightarrow 2NH_3 + H_2 + 16ADP + 16P_i$

Nitrification: $NH_3 + O_2 + 2H^+ \rightarrow NH_2OH + H_2O$

$NH_2OH + H_2O \rightarrow NO_2^- + 5H^+ + 4e^-$

$NO_2^- + H_2O \rightarrow NO_3^- + 2H^+ + 2e^-$

Nitrate Reduction:

$NO_3^- + 4H_2 + H^+ \rightarrow NH_3 + 3H_2O$

Denitrification:

$NO_3^- + 2H^+ + 2e^- \rightarrow NO_2^- + H_2O$ (nitrate reductase)

$NO_2^- + 2H^+ + e^- \rightarrow NO + H_2O$ (nitrite reductase)

$2NO + 2H^+ + 2e^- \rightarrow N_2O + H_2O$ (nitric oxide reductase)

$N_2O + 2H^+ + 2e^- \rightarrow N_2 + H_2O$ (nitrous oxide reductase)

$2NO_3^- + 10e^- + 12H^+ \rightarrow N_2 + 6H_2O$

The Sulfur Cycle:

