3.1 Physical geography

3.1.1 Water and carbon cycles

Systems in physical geography	
An overview of the concept and use of '**models**' by geographers as simplifications of a complex world. The concept of '**systems frameworks**' as a type of model fundamental to most areas of geographical understanding.	
Elements of geographical systems: **Stores/Components, Flows/Connections, Elements, Attributes, Relationships** Characteristics of systems: **Boundaries, Inputs, Outputs, Flows** **Isolated systems, Closed systems, Open systems.** Systems in a state of dynamic equilibrium - **Positive feedback, Negative feedback**	
The four major subsystems of the earth: **Atmosphere, Lithosphere, Hydrosphere, Biosphere** To understand that these are interlinked as a 'cascading system'.	
The Water Cycle	
Global distribution and size of major stores of water – **lithosphere, hydrosphere, cryosphere, and atmosphere.** On earth water exists in three forms: Solid ice, Liquid water, Gaseous water vapor	
Processes driving change in the magnitude of these stores over time and space, including flows and transfers: evaporation, condensation, (Latent heat) cloud formation, causes of precipitation and cryospheric processes at hill slope, drainage basin and global scales with reference to varying timescales involved.	
Drainage basins as open systems – **inputs** and **outputs**, to include precipitation, evapo-transpiration, and runoff; stores and flows, to include interception, throughfall, Transpiration. Surface storage, soil water, vegetation, groundwater, and channel storage; stemflow, infiltration, percolation, overland flow, and channel flow.	
The **water balance**: Inputs, outputs and store, River regime, Soil moisture budget	
Storm and flood hydrograph: Rising limb, Peak discharge, Lag time, Receding limb	
Factors affecting the water cycle: Deforestation, Soil drainage, Water abstraction, farming practices, land use change	
The Carbon Cycle	
Features of carbon as an element, its versatility and importance as a component of organic and inorganic compounds. The study of carbon dioxide (CO_2) is of most importance currently due to its perceived role in controlling climate. The origins of the carbon that we study in the carbon cycle.	
Global distribution, and size of major stores of carbon – **lithosphere, hydrosphere, cryosphere biosphere, atmosphere.**	
The movement of transfer between the carbon stores, studied above, at a range of scales: **Plant, Sere, Continental.**	

Transfers (fluxes): Photosynthesis, Respiration, Decomposition, Combustion, Burial Compaction, Carbon sequestration, Weathering.	
Factors leading to change in the carbon cycle: Wild fires, Volcanic activity, Hydrocarbon fuel extraction, Land use changes.	
The nature of the impacts of carbon cycle, and possible future changes, for: **the land, the oceans, the atmosphere and global** climate. **"enhanced greenhouse effect".**	
Water, Carbon, Climate and Life on Earth	
Positive feedback between CO_2 led warming leading to higher evaporation rates and a wetter atmosphere. The significance of water (water vapour and clouds) and carbon (CO_2) as greenhouse gases. Students to understand the dominance of CO_2 in controlling the *scale* of the greenhouse effect. Lag between increased emissions of CO_2 and any resulting temperature increase.	
Students to have a clear understanding of the concept of "mitigation". Interventions to reduce or prevent emissions. Carbon Capture and Sequestration (CCS), Changing rural land use, Improved transport practices.	
Water and climate in the Amazon tropical rainforest	
How changes in the water and carbon cycles have changed the tropical rainforest environment	
The relationships between hydrology, the carbon cycle and the environment	
How human activity affects the tropical rainforest.	
Strategies employed in the Amazon tropical rainforest to reduce the effects of climate change	
CASE STUDY – RIVER OUSE	
The hydrological system that affect channel flow • analyze the relationships between inputs and outputs in a local river. • Human and physical factors affecting the river basin • to understand implications for flooding on a local river.	