4.1 Introduction to Water Systems

Mark Schemes

Course	SL IB Environmental Systems & Societies (ESS)
Section	4. Water & Aquatic Food Production Systems & Societies
Topic	4.1 Introduction to Water Systems
Difficulty	Medium

To be used by all students preparing for
SL IB Environmental Systems & Societies (ESS)
Students of other boards may also find this useful

1a

Indicative Content	Commentary
Stores in the hydrological cycle include: Any **three** from the following: • Water storage in soil; [1 mark] • Lake / lagoon / pond / puddle / reservoir / dam; [1 mark] • Glacier / ice sheet / ice cap / ice; [1 mark] • Groundwater / groundwater storage / aquifer; [1 mark] • Surface water; [1 mark] • River / river channels / channel storage; [1 mark] • Vegetation / vegetation storage; [1 mark] • Interception / interception storage; [1 mark] • Sea / ocean; [1 mark] • Clouds / atmosphere; [1 mark]	A store is a place in the hydrological cycle where water is stored for an extended period of time This water is then moved between storages via hydrological flows or processes

1b

Indicative Content
Processes of water transfer in the hydrological cycle include: Any **two** pairs from the following: • Evaporation; [1 mark] • The process by which liquid water changes into a gaseous state / water vapour and enters the atmosphere from water bodies e.g. oceans/lakes/rivers; [1 mark]

OR

- Transpiration; [1 mark]
- The process by which plants absorb water from the soil through their roots and release it as water vapour through tiny openings/stomata in their leaves; [1 mark]

OR

- Evapotranspiration; [1 mark]
- The combined process of water vaporisation from the Earth's surface (evaporation) and the release of water vapour by plants through transpiration; [1 mark]

OR

- Sublimation; [1 mark]
- The direct transition of water from a solid (ice/snow) to a vapour state without melting first; [1 mark]

OR

- Condensation; [1 mark]
- The process in which water vapour in the atmosphere transforms into liquid water, forming clouds/dew, as a result of cooling; [1 mark]

OR

- Advection; [1 mark]
- The horizontal movement of water vapour / clouds / precipitation caused by the prevailing wind patterns; [1 mark]

OR

- Precipitation; [1 mark]
- The process of water falling from the atmosphere to the Earth's surface in the form of rain/snow/sleet/hail; [1 mark]

OR

- Melting; [1 mark]
- The process by which solid ice/snow changes into liquid water due to an increase in temperature; [1 mark]

OR

- Freezing; [1 mark]
- The process by which liquid water changes into a solid state / ice / snow due to a decrease in temperature; [1 mark]

OR

- Flooding; [1 mark]
- The overflow of water onto normally dry land, often caused by heavy rainfall / melting snow / dam failure; [1 mark]

OR

- Surface run-off; [1 mark]
- The movement of water over the Earth's surface, typically occurring when the ground is saturated/impermeable, leading to excess water; [1 mark]

OR

- Infiltration; [1 mark]
- The process of water seeping into the soil from the surface, entering the soil layers and becoming groundwater; [1 mark]

OR

- Percolation; [1 mark]
- The downward movement of water through the soil / underlying rock layers, eventually reaching aquifers / groundwater reservoirs; [1 mark]

OR

- Stream-flow / currents; [1 mark]
- The movement of water in streams / rivers / other water bodies, driven by gravity and the slope of the land, ultimately leading to oceans/lakes; [1 mark]

2

Indicative Content
The term thermohaline circulation refers to: Any **two** from the following: • (The mechanism driving) the global movement of (deep) ocean currents; [1 mark] • Driven by differences in temperature and salinity (of seawater); [1 mark] • Which involves the sinking of cold / dense(r) (sea)water at high(er) latitudes and the rising of warmer / less dense (sea)water at low(er) latitudes; [1 mark]

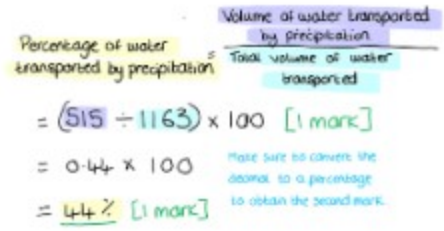
3a

Indicative Content
*i) Processes **G** and **H** are:* • Process **G** = precipitation / type of precipitation e.g. rain/snow/sleet/hail; [1 mark] • Process **H** = evaporation / vaporisation; [1 mark] *ii) Water vapour condenses and forms clouds because:* • It cools / decreases in temperature / loses kinetic energy; [1 mark]

3b

Indicative Content	Commentary
The percentage of water that is transported through precipitation can be calculated as follows: • 515 ÷ 1163; [1 mark]	For the command term calculate, you need to show all the steps, the final answer, and the unit (if available)

- 44.3% / 44%; [1 mark]



4

Indicative Content	Commentary
Urbanisation causes the reduction of storage components in the hydrological cycle in the following ways: Any **two** from the following: • Groundwater / aquifers / soil water storage decreases as urbanisation leads to decreased infiltration / increased runoff / increase in impermeable surfaces / urban withdrawal; [1 mark] • Atmospheric storage / humidity decreases due to reduced evapotranspiration caused by urbanisation / removal of vegetation/trees/plants; [1 mark] • The biomass storage component decreases due to deforestation / loss of trees in urban areas; [1 mark] • Snow/ice storage. decreases due to the urban heat island effect; [1 mark]	The hydrological cycle, also known as the water cycle, refers to the continuous process by which water circulates and moves between the Earth's surface, the atmosphere, and back again. It involves the transformation of water into various forms, such as liquid, vapor, and ice, as it travels through different stages of the cycle