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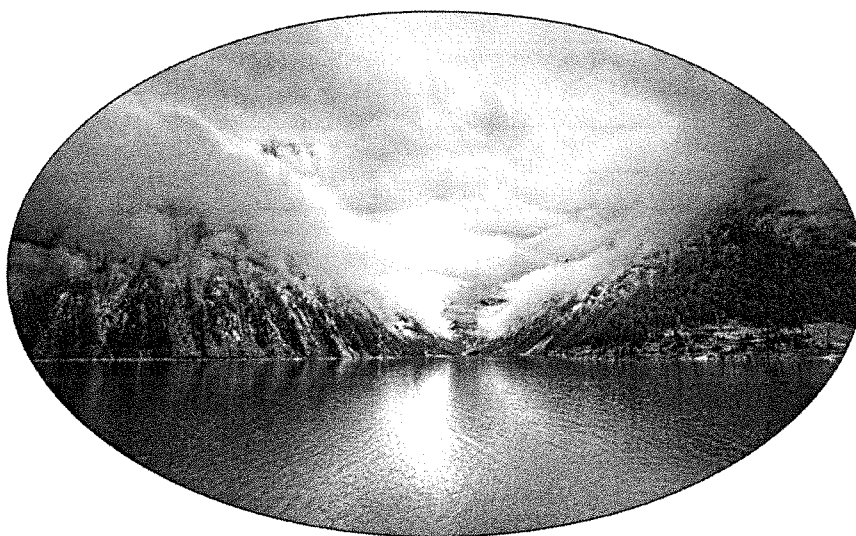
Class: _____

IB ESS

4.1 Introduction to Water Systems

Significant ideas:

The hydrological cycle is a system of water flows and storages that may be disrupted by human activity.

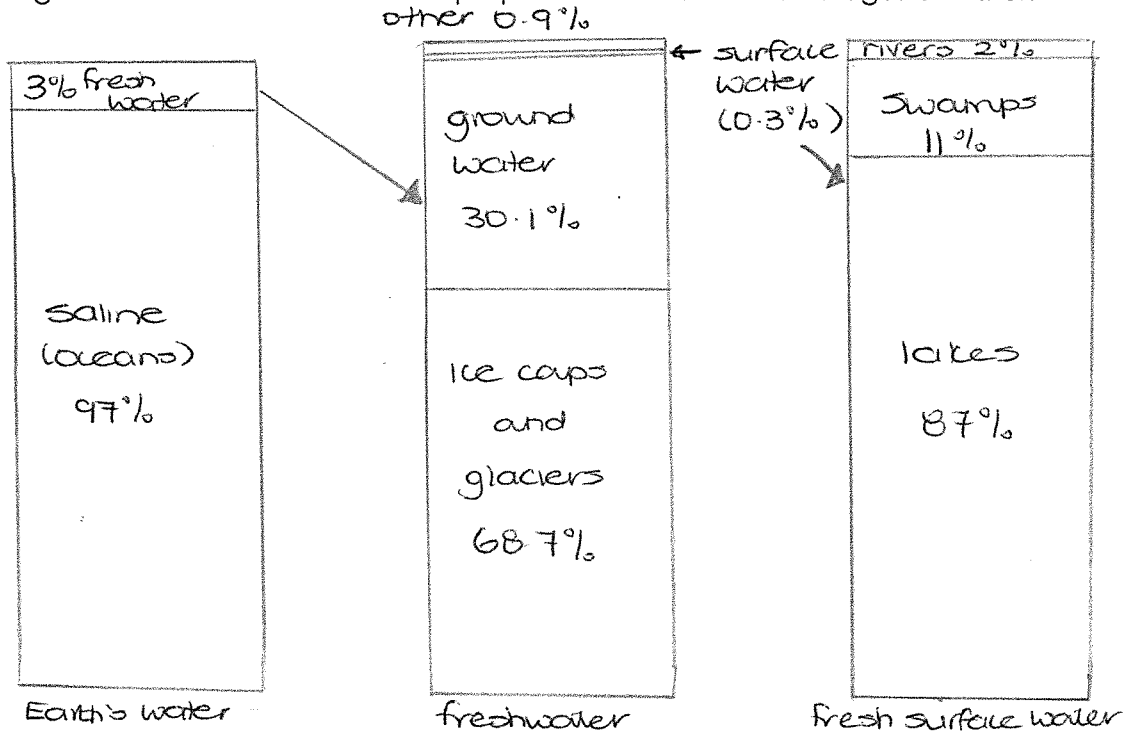


The Water Budget

1. State the energy source that drives the water cycle.

Sun (solar radiation)

2. Draw a diagram to summarise the relative proportions of the Earth's storages of water.



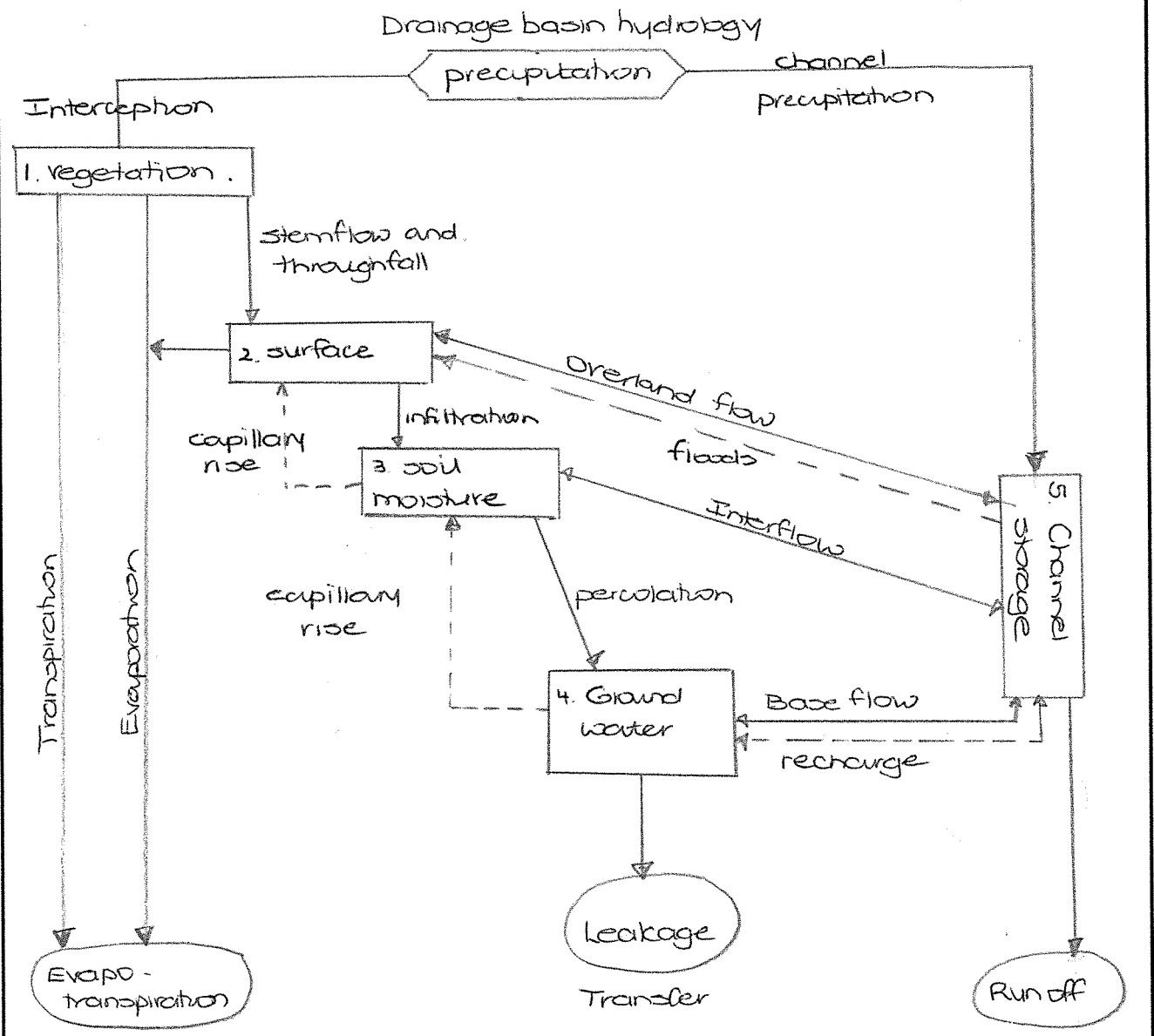
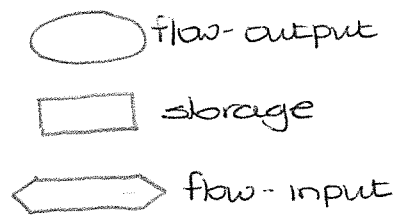
3. Roughly how long is the turnover time for water in each of the following storages?

Storage	Turnover time
Oceans	37 000 year non-renewable
Groundwater	300 years middle-ground
Atmosphere	9 days renewable
Icecaps	16 000 years non-renewable
Rivers	12-20 days renewable



3. Draw a systems diagram of the hydrological cycle. Include the following:

Storages	Flows
<ul style="list-style-type: none"> Organisms Oceans Groundwater Lakes Soil Rivers Atmosphere Glacier and ice caps 	<ul style="list-style-type: none"> Evapotranspiration Sublimation Evaporation Advection Precipitation Melting Freezing Flooding Surface run-off Infiltration Percolation Stream flow



Davis + Nagle (2017) Environmental system and societies: study and Revision Guide p 92



Human Activities

1. Outline how the following human activities can impact the water cycle:

Withdrawals

As more water is withdrawn for domestic use, irrigation in agriculture and industry less surface water is available for evaporation

Discharges

Adding pollutants to water eg. chemicals from agriculture, fertilizer and sewage reduces the quality of water

Changing the speed of flow

Rivers can be channelled underground in urban areas, straightening large sections of rivers in concrete channels, with dams, barrages and dykes

Diverting rivers

many diverted away from important areas to avoid flood damage some are diverted towards dams for storage.

2. Explain how urbanisation can lead to flash floods.

The surface of cities is impermeable (roads, buildings). When rain falls it can not penetrate into the soil and so runs off the surface and can result in flash floods as the run off builds up.

Where open spaces exist the soil is often heavily compacted due to high recreational use so less permeable.



Ocean Circulation

1. Outline what is meant the "the oceanic conveyor belt".

A pattern of ocean currents that is caused by deep water currents (thermohaline currents)

Makes of 90% of ocean currents.

2. In terms of temperature and density, explain how global ocean currents move.

Warm water can hold less salt than cold water so is less dense and rises. Cold water holds more salt, is denser so it sinks.

When warm water rises, cold water comes up from the depths to replace it (upwelling)

When cold water rises it has to be replaced by warm water in downwellings

In this way the water circulates

see Rutherford and Williams p 203

3. Explain how...

Ocean currents affect climate

Water has a higher specific heat capacity than land. Water masses heat up and cool down more slowly than land masses.

Land close to seas and oceans have a milder climate

Climate affects ocean currents currents can also bring high temps e.g Gulf stream moderates the climate of NW Europe.

If global warming results in increased rainfall in the North Atlantic and the melting of the sea ice this will disrupt the sinking of cold, salty water and disrupt the thermohaline currents

Climatic phenomena such as El Niño Southern Oscillation

has major impact on ocean currents.

Global warming is also slowing down the Gulf stream



