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Date: _____

Class: _____

IB Environmental Systems and Societies

4.1 Introduction to water systems

Significant ideas:

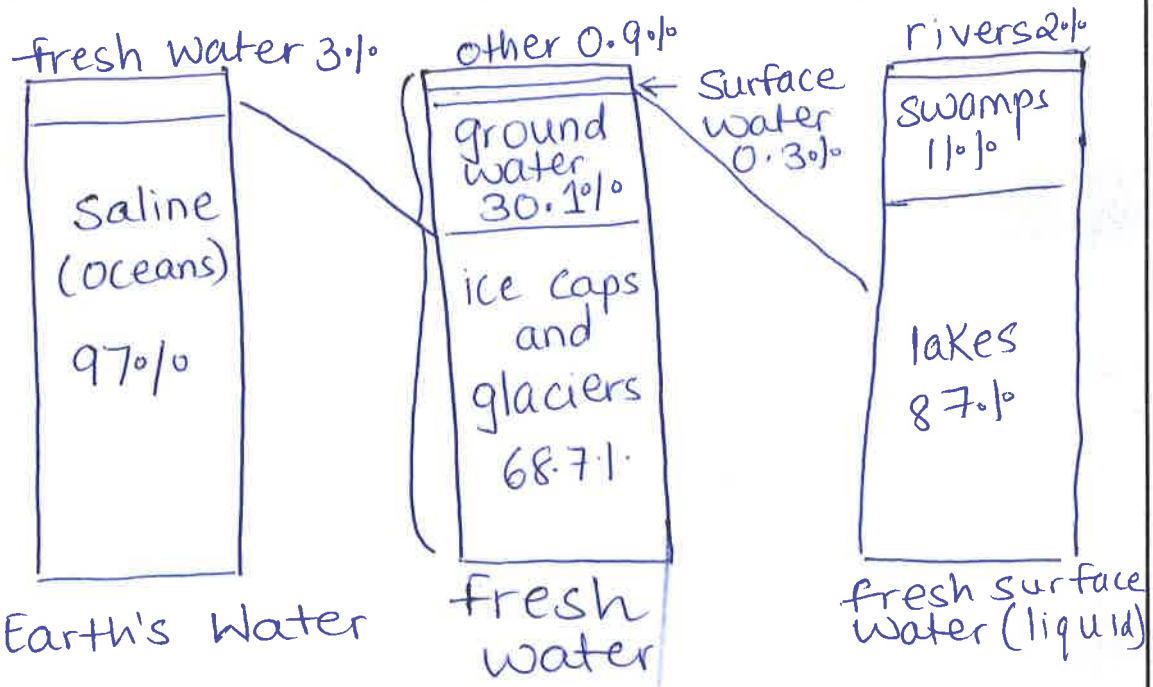
The hydrological cycle is a system of water flows and storages that may be disrupted by human activity.

The water budget

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

Sun

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

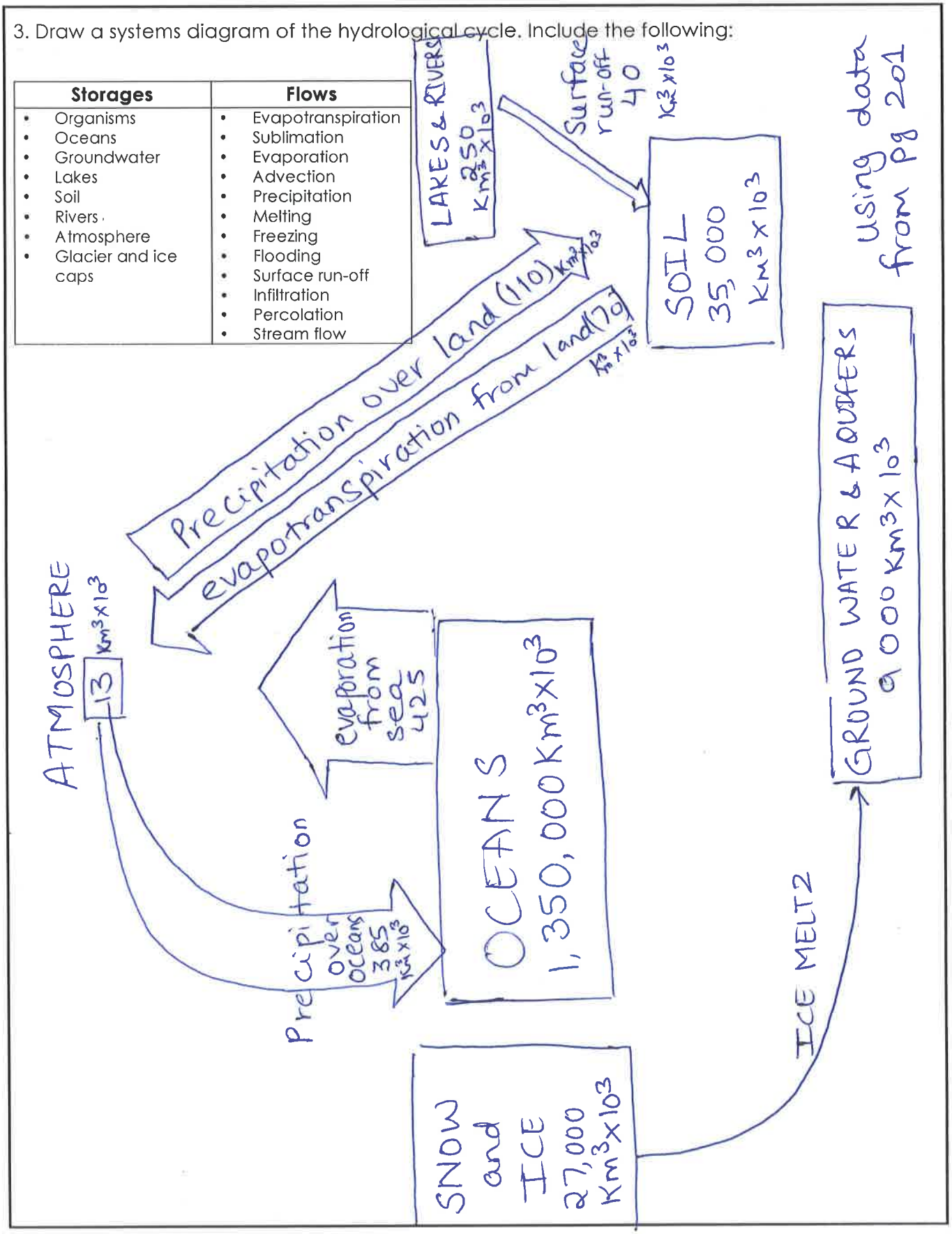


3. Roughly how long is the turnover time for water in each of the following storages?

Storage	Turnover time	
Oceans	37,000 years	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
• Organisms • Oceans • Groundwater • Lakes • Soil • Rivers • Atmosphere • Glacier and ice caps	• Evapotranspiration • Sublimation • Evaporation • Advection • Precipitation • Melting • Freezing • Flooding • Surface run-off • Infiltration • Percolation • Stream flow



Human Activities

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

Withdrawals

Humans interrupt the movement of water by the following activities:
for domestic use, irrigation in agriculture and industry. It reduces the freshwater storage.

Discharges

by adding pollutants to water, eg chemicals from agriculture, fertizers, sewage.

Changing the speed of flow

- Canalizing: straightening large sections of rivers in concrete channels to facilitate more rapid flow through sensitive areas.
- making dams, barrages and reservoirs.

Diverting rivers

- Aral sea → intense irrigation has stopped river flow into the sea and ~~stopped~~ lowered the sea level.
- Ganges basin - deforestation increases flooding as precipitation is not absorbed by vegetation.

2. Explain how urbanisation can lead to flash floods.

→ Flash floods occur when rainfall or snowmelt cannot infiltrate the soil and runs off on the surface.

→ In Manila, capital of the Philippines, 50% of the city was flooded in 2012 after record rainfall.

Ocean Circulation

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

Ocean currents are movements of water both vertically and horizontally. Ocean currents have an important role in the global distribution of energy. The thermohaline circulation is sometimes called the ocean conveyor belt.

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

- Deep water currents, also called thermohaline currents, make up 90% of ocean currents
- They are due to differences in water density caused by salt and temperature
- cold water holds more salt, is denser so sinks
- when warm water rises, cold has to come up from depth to replace it. these are upwellings
- Cold ocean currents run from poles to the equator - the Humboldt current, the Benguela current

3. Explain how...

Ocean currents affect climate

1. The warm Gulf stream/North Atlantic Drift moderates the climate of Northwestern Europe, which otherwise would have a sub-arctic climate
2. The Benguela current moderates the climate of the Namibian desert.

Climate affects ocean currents

- If global warming results in increased rainfall in the North Atlantic, and the melting of sea ice. This will disrupt sinking of cold, salty water
This sequence of events would stop the conveyor belt, would result in drastic temp changes in Europe.

- warm currents flow from equator to the poles
  - the Gulf Stream
  - the Angola Current