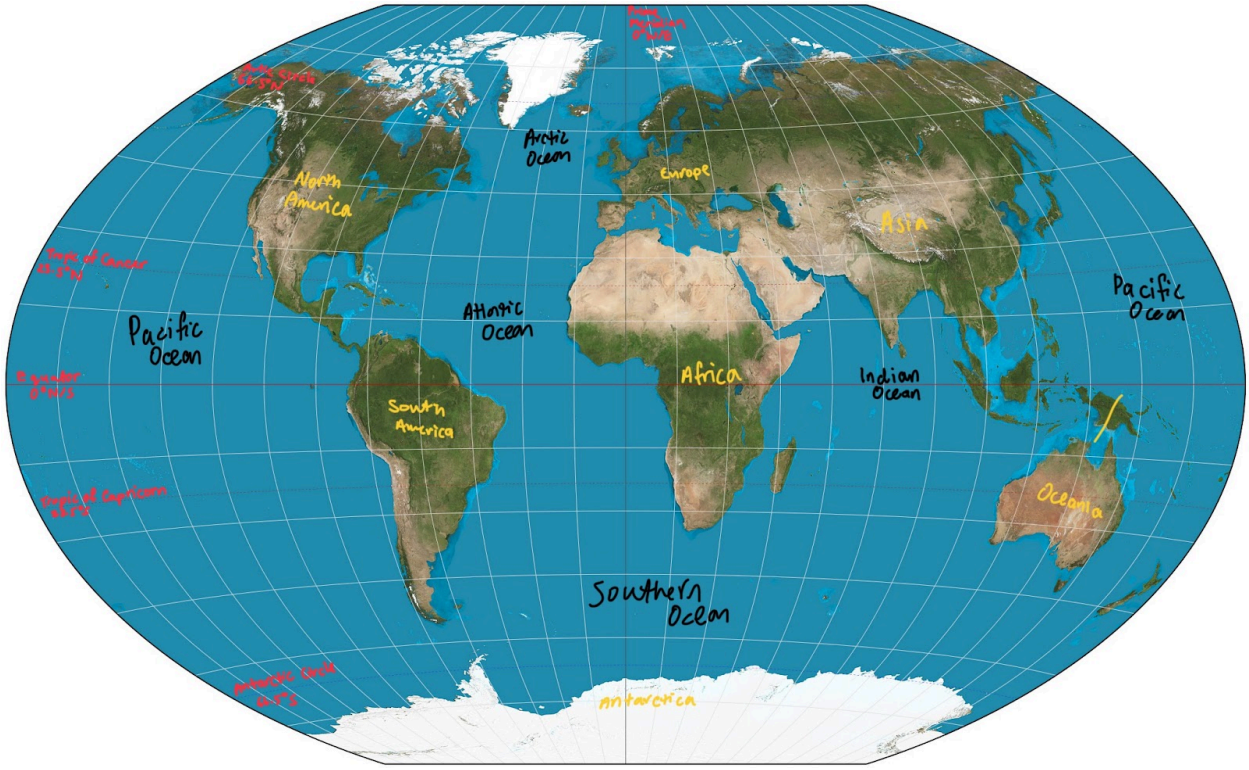
Sec 1 G3 Geography Revision Notes - Courtesy of OM MAHTO

Mapwork:



You must know all the continents, oceans, and of course where they are; major latitudes (horizontal) and longitudes (vertical) and the coordinates of them respectively.

When labeling a latitude or longitude, remember to write the coordinates of them down as well.

COORDINATES:
Writing coordinates start with latitude, then longitude.
E.g. Singapore's coordinates are **1.3521°N, 103.8198°E**
(You cannot flip and write East first then North)

1: Introduction to Geography

Geography is the study of Earth, including physical and built environments, as well as the **relationships** that people have with both these types of environments. A person studying **geography** is known as a geographer.

1.1: PHYSICAL GEOGRAPHY

- branch of geography that focuses on the study of the **physical** environment
- it consists of all living and nonliving things that are found naturally, as well as the natural processes that occur on Earth.

It has four components:

- Atmosphere
- Hydrosphere
- Lithosphere
- Biosphere

Atmosphere:

- layer of gases and tiny particles that surrounds the Earth. Some examples of gases that make up the atmosphere are nitrogen, oxygen and carbon dioxide. It is further divided into five layers - troposphere, stratosphere, mesosphere, thermosphere, and exosphere. The condition of the atmosphere at a given time and place is known as the weather, which includes temperature, humidity, rainfall and wind.
- **Troposphere (0-10km)**: The lowest layer of the Earth's atmosphere. Most clouds, precipitation and other weather elements occur within this layer.
- **Stratosphere (10-50km)**: The layer of the atmosphere above the troposphere. Within the stratosphere, temperature usually remains constant.
- **Mesosphere (50-80km)**: The layer of the atmosphere directly above the stratosphere and below the thermosphere. Throughout the mesosphere, temperature decreases with height.
- **Thermosphere (80-700km)**: The layer of the atmosphere above the mesosphere, extending to the uttermost fringe of the atmosphere. In this layer, temperature increases sharply in the lower thermosphere, then drops off and holds steadily with increasing height.
- **Exosphere (>700-190,000km)**: The outermost layer of the Earth's atmosphere.

Hydrosphere:

- Refers to all water found on the Earth and in the atmosphere. It includes water in its solid, liquid and gaseous states. The hydrological cycle enables water to move continuously between the Earth's surface, the atmosphere and underground.

Lithosphere:

- is the solid layer of rock that forms the Earth's surface. It can be up to a few hundred kilometres in thickness. Magnificent landforms such as mountains and valleys are created by the movement of large layers of rock within the lithosphere.

Biosphere:

- refers to all living things on Earth, including plant and animal life found on land and in the sea. It is dependent on the other components of the physical environment. For instance, plant growth requires suitable temperatures, rainfall and soil conditions.

1.2: HUMAN GEOGRAPHY

- branch of geography that involves the study of human life in the **built environment**
- is created through human-made changes to the physical environment. It provides the setting for a variety of human activities and interactions among people.

It has many aspects, such as:

- housing
- transport systems

Housing:

- refers to structures or buildings developed by people to shelter themselves from the elements. It can be temporary or permanent. An example of temporary housing is a tent in a campsite, while an example of permanent housing is a block of Housing and Development Board (HDB) flats.

Transport Systems:

- refer to the equipment, infrastructure and networks that support the movement of people and goods from one location to another. For instance, public buses, Changi Airport and the Mass Rapid Transit (MRT) network form part of Singapore's transport system.

1.3: GEOGRAPHICAL CONCEPTS

- is an important idea that geographers make use of to understand the world. There are four key geographical concepts of space, environment, place, and scale.

Space:

- refers to a physical area on the Earth's surface. Schools, shopping centres and parks are found in different physical areas. Geographers may refer to them as spaces for learning, business, and recreation respectively.
- **Location** is an idea that is closely related to space. It can be expressed using a set of coordinates, which is based on a global system of imaginary horizontal and vertical lines known as **latitude** and **longitude** respectively. For instance, Singapore's location is 1° North 103° East.
- The location of individual geographical features, such as mountains or roads, may be arranged across an area in a particular way. This is known as a spatial pattern. Spatial patterns can be identified as **linear (in one line), dispersed (completely random), or nucleated (clustered together).**

Place:

- refers to an area of the Earth's surface that holds special meaning for people. For example, people are likely to consider the neighbourhood they grew up in or the primary schools they attended as special places. As these places were settings for daily activities that they used to take part in, they would have developed memories and feelings towards these places over time.

Environment:

- refers to the physical and built environments, as well as the processes that occur naturally or result from human actions. Geographers are interested in studying the interactions between humans and the physical or built environments. They are keen to find ways to minimise the negative impacts of humans on these environments

Scale:

- refers to the level of detail at which geographers study something. There are three different types of scale that geographers often use.
- **Map scale:** Maps are diagrams that represent features of the physical and built environments, such as rivers and cities. **Map scale** is the relationship between a distance on a map and the actual distance on the ground. It can be expressed as a representative fraction or as a statement. For instance, a 500-meter-long road may be represented as being 5 centimetres long on a map. The map scale in this case is thus "1:10,000" or "1 centimetre represents 100 metres"
- **Time scale:** the period of time during which something happens. Geographers need to consider time scales because processes and changes in the physical and built environments occur at a variety of time scales, from seconds to weeks, to decades and even to millennia.
- **Geographic scale:** spatial extent of something. It is often divided into local, national, regional and global scales. For example, a village or town centre is considered to be at the local scale. The national scale includes the whole country, whereas the regional scale covers a group of countries that are located close to one another, such as Southeast Asia. The global scale refers to the entire world. Geographers can study features or processes in the physical and built environments at one of these geographic scales or even several of them.

1.4: GEOGRAPHICAL INQUIRY:

- is an approach that geographers take to understand the world. It involves posing geographical questions and carrying out geographical investigations.

Geographical questions:

- The words *who, what, where, when, why and how* are commonly used to form questions. These question words can be used together with the four key geographical concepts to pose geographical questions about a **phenomenon** and any **issue** that it may cause. A phenomenon is a feature or situation that can be observed to exist or happen in the physical or built environments, such as a waterfall or traffic congestion.

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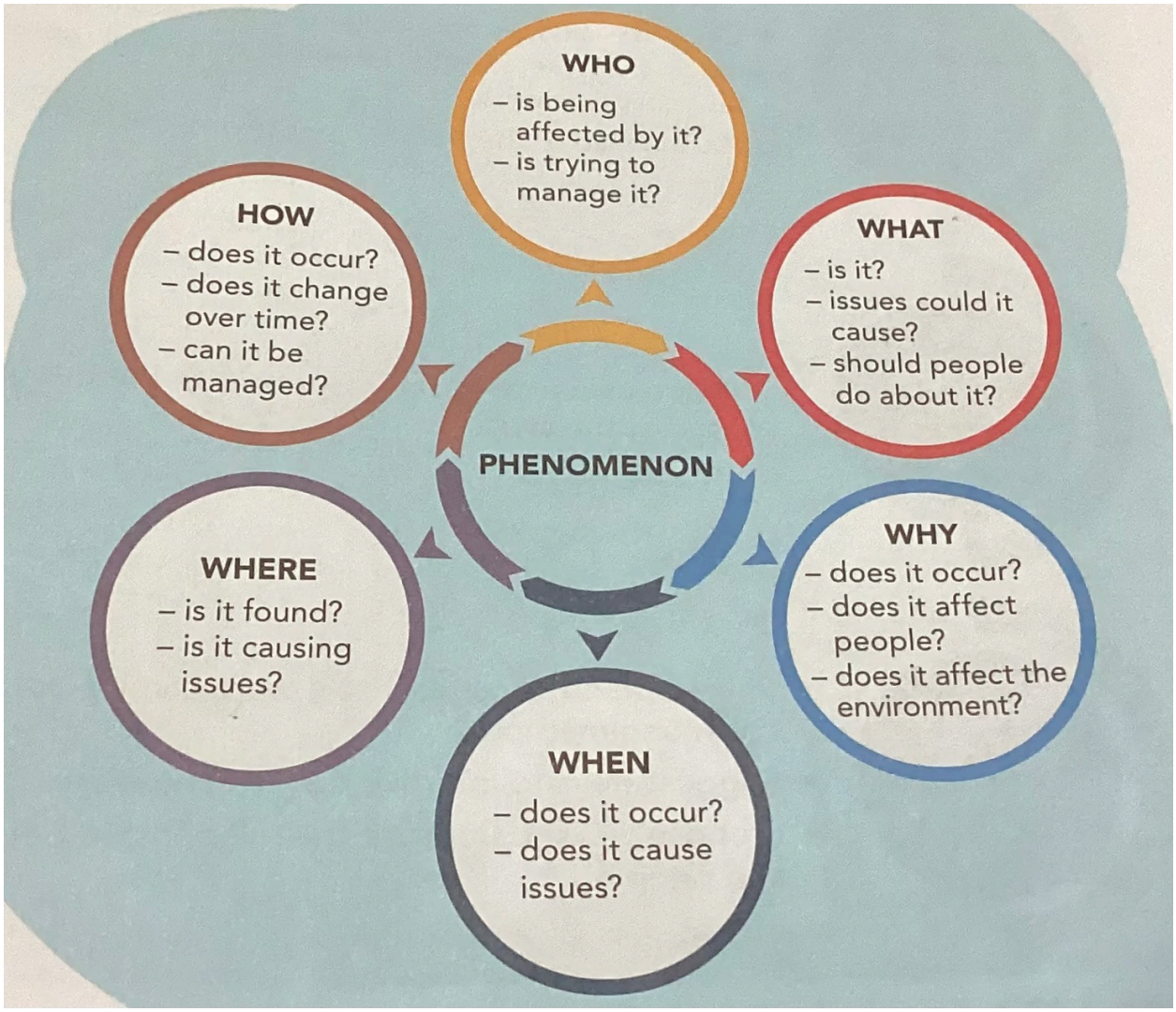

Geographical investigations:

- is a systematic study that is carried out to find possible answers to geographical questions posed. It consists of five different stages.

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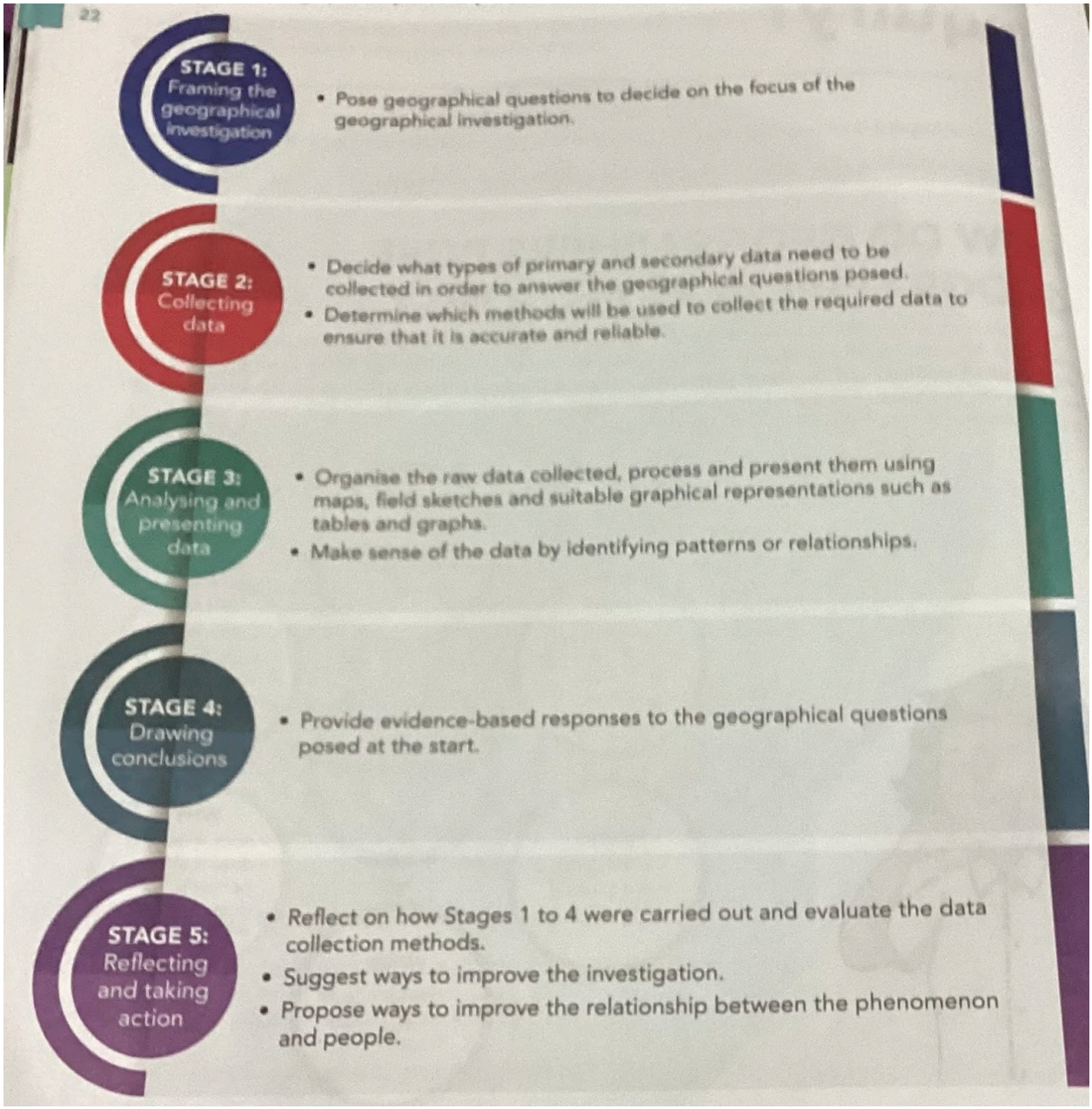


2: Sustainable Management of Natural Resources

- Actions taken to ensure that the natural resources present today continue to be available for future generations.

2.1: Resource

- a material that is identified by people to be **useful**
- When this material is made into a product, the product can also be considered a resource as well because it is useful too.
- A resource can **fulfil people's needs and enhance their well-being.**

What is a resource to one group might not be for another group. Technology and culture can shape how we decide if a material or an object is useful to people.

Culture:

- refers to the way of **life** which a group of people share, e.g. The Penan tribe which is indigenous and lives in TRFs.
- To them, timber would be a resource to them as they need wood for their shelters but they would not consider cement a resource unlike us.

Technology:

- can **influence** people's ability to identify resources.
- Before machines were invented, animals were used for laborious work and considered a resource for farming (to plough their fields) Now, machinery like power tillers and combine harvesters are increasingly being used so animals are less likely to be seen as a valuable resource.

2.2: Natural Resource

- useful materials found on Earth produced by natural processes occurring in the physical environment. E.g. Water and solar energy
- can be categorized into renewable and non-renewable.

Renewable resources:

- refer to materials that are replenished **naturally** more or less within the same time period they are used.
- The availability of renewable resources, which refers to the amount that exists, is considered to be unlimited.
- Water and solar energy are renewable. Energy from the Sun is captured by solar cells, which convert into electricity that we can use. As sunlight is received daily, solar energy that is used up at the end of the day can be replenished the next day.

Non-renewable resources:

- refers to materials which may or may not be replenished naturally. If they are replenished, then the natural processes occur very slowly and take such a long time that it is beyond the period used.
- Their availability thus is limited.
- Crude oil is non-renewable. As crude oil takes millions of years to form, the rate of replenishment is too slow to increase its availability in the near future.

2.3: People's Views

- The use of natural resources is influenced by people's views; either **nature-centred or human-centred**.

Nature-Centred:

- the physical environment with its natural resources is seen as valuable in itself. Everything that is naturally found in the physical environment, like trees, animals, rivers, mountains, is as important as humans. Therefore, the physical environment should be **preserved**, meaning it should be protected and restrained in its original state as far as possible. People's use of the physical environment should be minimized and even prohibited.

Human-Centred:

- the physical environment is valuable because humans can obtain materials from it for their use and benefit. People with this view are motivated to find ways to extract these natural resources to enhance their personal well-being or to sell them in exchange for money.
- Extraction of natural resources can negatively impact the availability of resources and the physical environment. If **extraction** occurs at a faster rate than natural renewal, the availability of the natural resource will be **depleted**. **Environmental degradation** can occur too.

2.4: Sustainable Use of Natural Resources.
(Written by my friend, language is terrible on purpose to make it fun!)

Sustainable use of natural resources-
Refers to actions people can take to ensure that the natural resources we have on Earth today continue to be available for future generations. (Eg. Saving water by turning off the tap while brushing your gummy gum gums, washing your greens in a bowl or switching off the air con when leaving a room or house)

When we extract natural resources from Earth in the short term, that is, over the next few years, we need to be aware of the possible impact in the long term for the next 10, 20, 30 or more years. (Like wasting electricity <zaaap> or wasting water. <swish slosh>)

We will then be careful about the amount of natural resources we are using now. We can also try to reduce the environmental degradation (basically wear and tear) that may occur.

If we are using some natural resources at a much faster rate today than they can be naturally replenished over time, what may happen in the future is that renewable natural resources become non-renewable. (Rly bad, not poggers)
Hence, its availability changes from unlimited to limited. An example is tropical rainforests. Wood from tropical rainforest trees is useful for many purposes such as the manufacture of furniture and paper products and to meet people's demand for wood, trees are being cut down

at a much faster rate than they can be naturally grown back. If this continues, there is a chance that tropical rainforests may become non-renewable.

We will discover more about the characteristics and uses of tropical rainforests in Chapters fiev and sigs.

As for non-renewable resources, their availability may fall to very low levels or even become depleted such as oil. When this happens, our future generations will not be able to make use of them. They may have to seek alternative resources. To avoid such a situation, we can take actions towards **sustainable (that future generations can use)** use liek solar panel and stuff :33333

2.5: How Can We Use Natural Resources Sustainably?

- Reduce
- Reuse
- Recycle
- Recover

EXAMPLE QUESTIONS:

1. Describe how food waste can be recovered. [2]

- Food waste can be recovered through **composting**, (1m) where the **organic matter in food waste is decomposed by fungi and bacteria to form nutrient-rich fertilisers** (1m).
- OR
- Food waste can be recovered through **decomposition by insects** (1m) like black soldier flies, where the insects **up-cycle the nutrients** in food waste to **form nutrient-rich fertilisers**. (1m)

2. Besides recovering food waste, suggest three other ways for an individual to conserve natural resources using each of the remaining 3Rs. [3]

- Individuals may actively **recycle materials such as used paper, used plastics and/or aluminium tin cans** (1m). Individuals may also use **reusable shopping bags** when buying groceries (1m). Individuals may **reduce their usage of disposables by using their own containers** when taking away food. (1m)
- *Answers with both reduce and reuse concepts in one suggestion will be considered as one marking point*
- *1m for each point, max 2m if students did not address all 3 aspects (Reduce, Reuse, Recycle)*
- *Accept any other plausible answers*

3: Spatial Distribution of Water

3.1: Water

Physical states of water:
- Solid: hail,snow
- Liquid: rain, river
- Gas: water vapour, steam

Water Stores: places where water is contained in, can be classified as saltwater or freshwater stores.

SALTWATER STORES:
1) 96.5%: Oceans (large body of saltwater. All oceans are interconnected) e.g. Pacific Ocean, Southern Ocean

FRESHWATER STORES:
1) 1.7%: Glaciers (large masses of ice that rest on land or float on water) e.g. Greenland Ice Sheet, Antarctica
- **Needs to be somewhere where it snows throughout the year; polar climate —> enough snow is accumulated to harden into ice.**

2) 0.76%: Groundwater (water that is stored below the water table) e.g. Arabian Aquifer System

3) 0.007%: Lakes (large water bodies surrounded by land) e.g. Lake Victoria, Lake Baikal

4) 0.002%: Rivers (natural wide flows of freshwater across the land that store water temporarily before water flows into another water body) e.g. Yellow River, Yangtze River
- **Rivers flow downstream; as it flows from places of higher elevation to lower elevation due to gravity.**
- **River Source: start of the river; River Mouth: the point until water flows into another water body.**

-

5) 0.001%: Soil Moisture (water that is stored in the soil below ground surface) e.g. Soil

ADDITIONAL WATER STORE:

- Peatland Swamp Forest. E.g. Borneo Peat Swamp Forests

EXAMPLE QUESTIONS:

Using the information of percentages of water in water stores, what is the global distribution of water? [4]

- Water is **unevenly** distributed on Earth. (1m - General Pattern) Oceans have the **highest** percentage at 96.5% while soil moisture has the **lowest** at 0.001%. (3m)
- *Leave 1m for data, 2m for comparison; can say oceans store the most water at …*

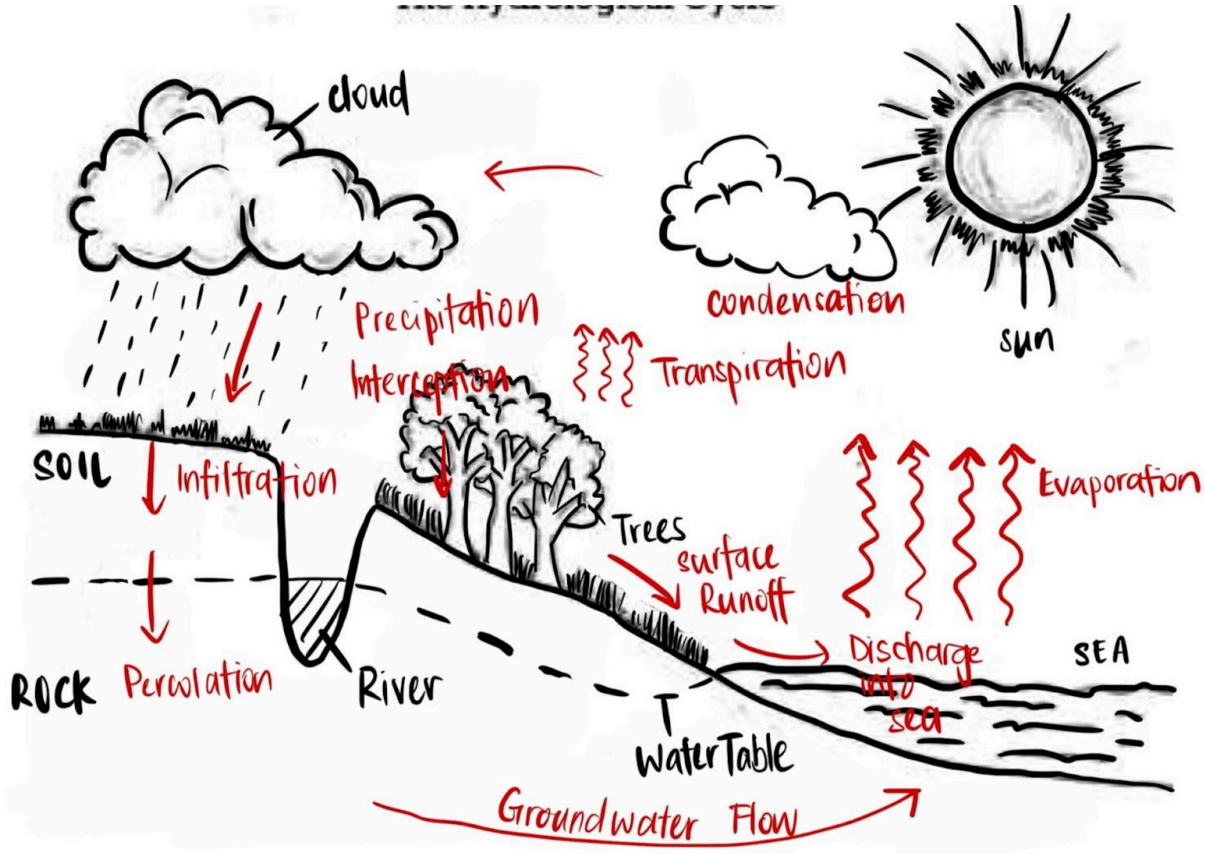
From the info above, why can water be considered a limited resource? [2]

- **Most** of the water on Earth is **saltwater** in oceans at 96.5% (1m) so only about 3.5% of all of the water on Earth is **safe for consumption** (1m)
- *Either one for 1m*
- Moreover, **most** of the freshwater on Earth is **locked away in glaciers and groundwater** (1m)

What is the global distribution of glaciers? [3]

- **Major** glaciers are found at **high latitudes** between the **Arctic Circle and North Pole** and between the **Antarctic Circle and South Pole.** (1m - General Pattern) This can be seen from the glaciers in **Greenland and Antarctica**. (1m - Evidence) However, there are **exceptions** where glaciers are found on **mountain ranges on lower latitudes** like **the Himalayas and Mount Kilimanjaro**. (1m - Anomaly/Exception)

3.2: Hydrological Cycle



Hydrological Cycle:

- the sequence of physical processes that occur to ensure water is naturally replenished on Earth.

Evaporation:

- Heat from the sun causes water to change from water to water vapour

- **increase of temperature = increase in rate of evaporation**

Condensation:
- process where water vapour loses heat and changes into water droplets, which coalesce to form clouds

Precipitation:
- process where water falls back on Earth's surface as rain, hail, snow or sleet

Interception:
- process by where precipitation is slowed down by the vegetation and doesn't reach the soil directly.
- **Makes water droplets to infiltrate the soil easier.**

Infiltration:
- process where precipitation enters the soil from ground surface.

Percolation:
- process where water moves into deeper layer of soils due to gravity and eventually reaches the groundwater store.

Groundwater flow:
- flow of water underground in aquifers. Water may return to the surface of springs or seep into the oceans.

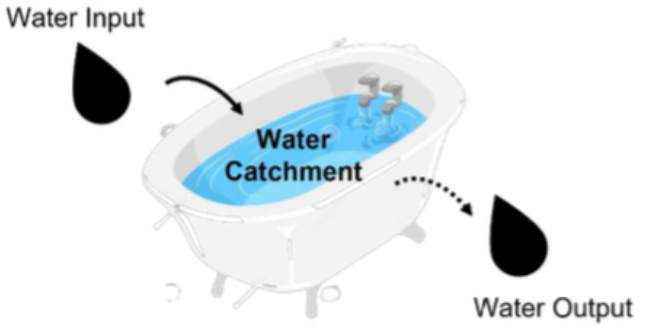
Surface Runoff:
- flow of water from the highlands and over the ground surface into streams and rivers

Discharge into the sea:
- Water from land eventually flows into the sea due to the force of gravity

Transpiration:
- Plants give out water vapour through their leaves to cool themselves down
- **increase in temperature = increase in rate of transpiration**

3.3: Water Budget

Water Budget:
- is a way to describe the flow of water in and out of a catchment area. It tells us how much water is available in a catchment.



WATER INPUT: (water goes into the catchment area)

- Precipitation

WATER FLOWS: (water flows in the catchment area)

- Surface runoffs
- Groundwater flow
- Infiltration
- Interception
- Percolation

WATER OUTPUTS: (water leaves the catchment area)

- Evaporation
- Discharge into the sea
- Transpiration

How do we calculate the net change in water storage?

Net Change in Water Storage = Water Input - Water Output

EXAMPLE QUESTIONS:

a) Calculate the net change in water storage for the water catchment. Show your workings clearly in the space below if Precipitation is 1923mm/y and Potential Evapotranspiration is 1307mm/y. [2]

- **Net change in water storage = water input - water output**
  = 1923mm/y - 1307mm/y
  = 616mm/y

b) Describe the water balance in the water catchment area. [2]

- The water catchment area experiences water **surplus** (1m) as it has a **positive** net change of water storage of **616mm/y** (1m)
- *1m each. Reserve 1m for the use of data.*

- IF THE QUESTION ANSWER IS WATER DEFICIT:
- The water catchment area experiences water **deficit** (1m) as it has a **negative** net change of water storage of [data] (1m).

Describe what it means by 'water deficit'. [2]

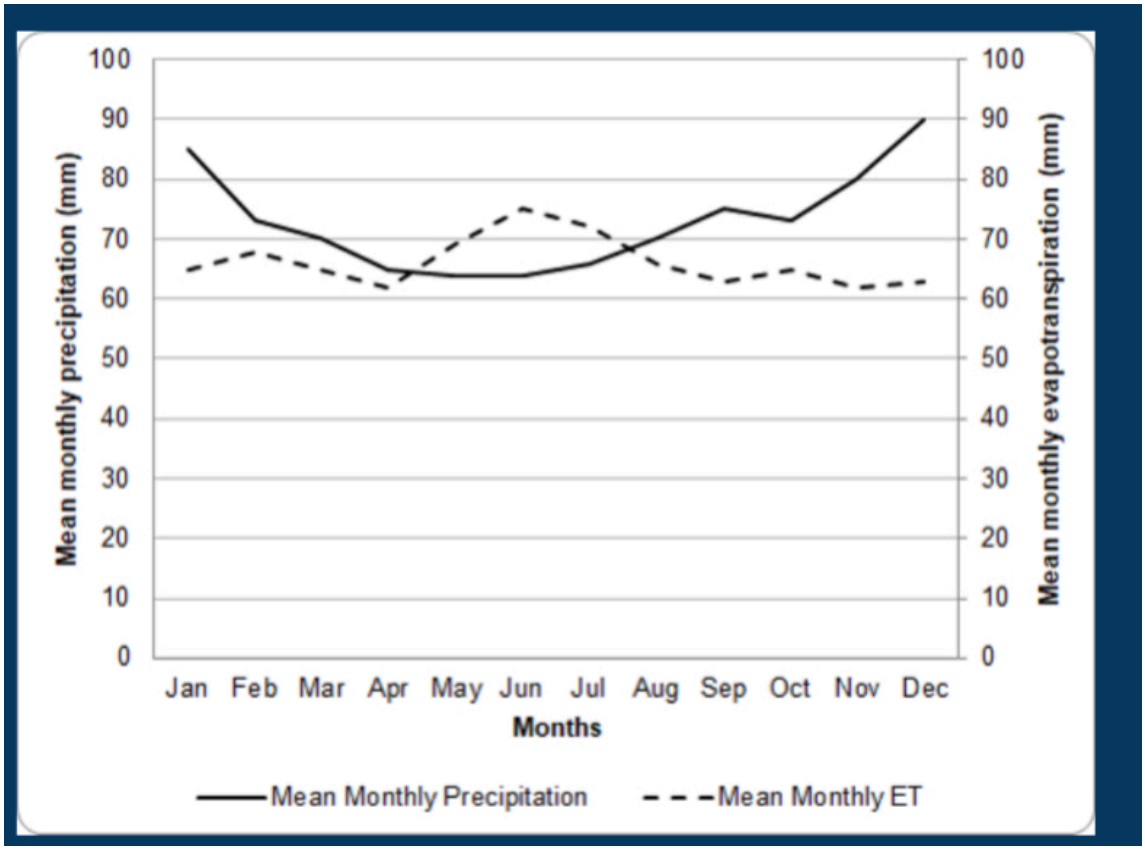
- Water deficit refers to a situation where **water output is greater than water input** in a water catchment area. (1m) This results in a **negative** net change in water storage. (1m)

- IF THE QUESTION ASKS FOR 'SURPLUS'
- Water surplus refers to a situation where **water input is greater than water output** in a water catchment area. (1m) This results in a **positive** net change in water storage. (1m)

If Net Change in Water Storage for B = -800mm/y while Net Change in Water Storage for D = -100mm/y, **compare** the water budgets of B and D. [3]

- Similarity: **Both B and D experience water deficit**. (1m) B experiences a negative net change in water storage of about **-800mm/y** while D experiences a negative net change in water storage of about **-100mm/y.** (1m)
- Difference: **B experiences a greater water deficit as compared to D**. (1m)
- *1m each. Reserve 1m for the use of data. Max 2m if no difference or similarity*
- *Here data is given. In exams you need to find it out.*

IMPORTANT TO NOTE:
Contrast - Describe the differences only
Compare - Describe **BOTH** similarities and differences



You'll also need to learn how to read graphs like this, and know whether this is a water surplus or water deficit.

4: Sustainable Management of Water

4.1: Floods, Droughts, and River Ecosystem

Flood is an **overflow** of a **large amount of water** onto what is **normally dry land**.
Two common types of flood are:

- flash floods
- river floods

How are flash floods caused?

- Flash floods are caused by **exceptionally heavy rainfall over a short period of time.**
- They often occur in **dry areas where there is not enough soil or vegetation** to allow rainwater to infiltrate the ground.
- These rainwater become **surface runoffs and quickly flood low-lying areas.**

How are river floods caused?

- River floods are usually caused by **sustained heavy rainfall**, or

- **meltwater produced when snow and ice start to melt in spring (**which is after winter)
- **Large amounts of rainwater and/or meltwater** enters the **rivers**.
- **Water level in the rivers rises rapidly and overflows the banks**, flooding the surrounding areas.

What are droughts and how are they caused?

- Drought is a **long period of little or no rainfall in a specific area.** (Definition tested 1m)
- It may last for **months or even years**, causing areas to be drier than normal.
- **Water stores** such as reservoirs and groundwater will start to **dry up**.

RIVER ECOSYSTEMS:

How does water support river ecosystems?

- **Precipitation** provides a **regular supply of water to rivers** so that organisms can live in it.

What are river ecosystems?

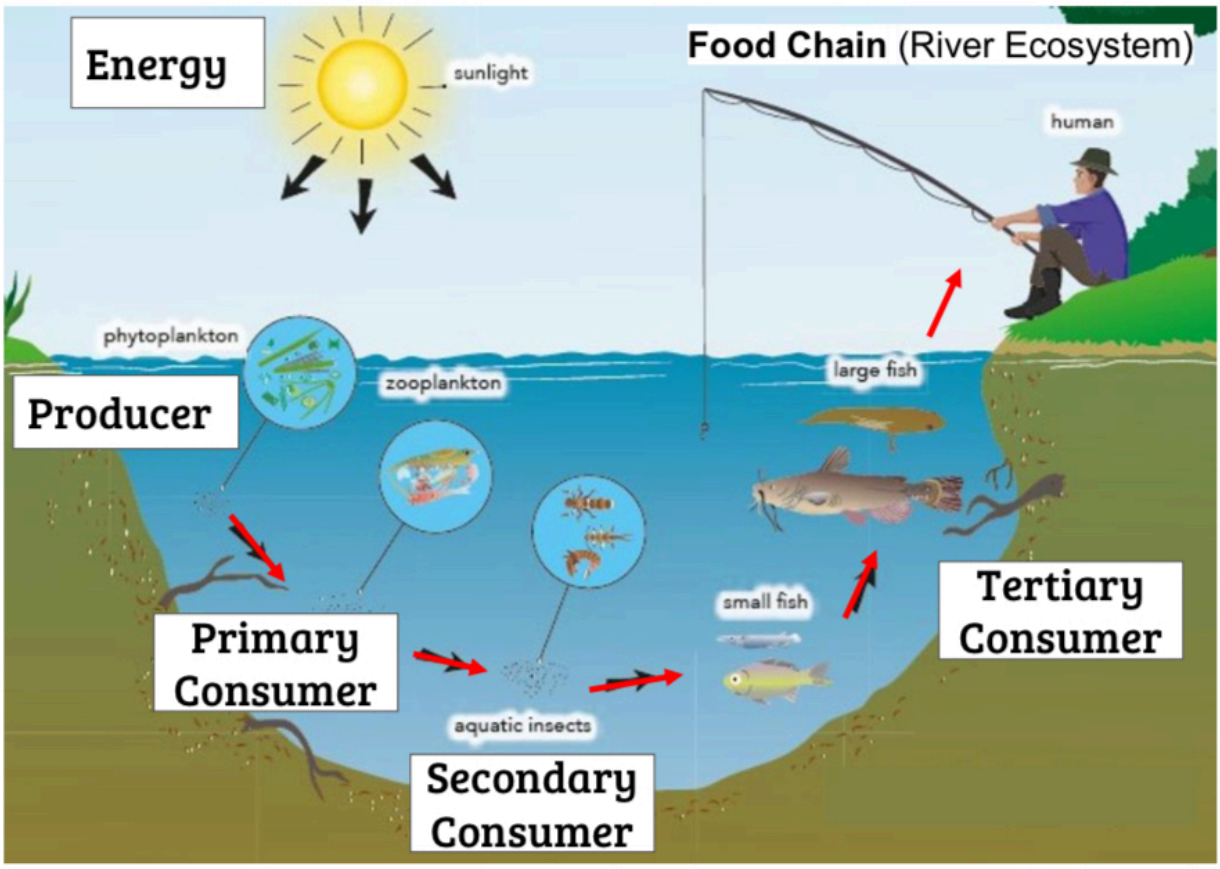
- Ecosystems refer to communities of plants and animals that interact with one another in a river. (Definition tested 1m)

A **food chain** describes the **relationship among organisms** in an ecosystem as **energy is transferred through food.**
Predators eat prey to gain energy they need to survive.

What does a river ecosystem look like?

- **Producer:** Aquatic plants which are able to photosynthesis captures the energy from the sun
- **Primary Consumer:** Organisms which feed on the aquatic plants (producers) - usually herbivores.
- **Secondary and Tertiary consumers:** Secondary and tertiary consumers prey on other organisms in the food chain.
- *Humans sit on top of the food chain.*

How does a river ecosystem look like?



Usually is phytoplankton —> zooplankton —> aquatic insects —> small fish —> large fish —> human

4.2: Uses of Water

Domestic, Industrial, Agricultural and Recreational.

EXAMPLE QUESTIONS:

State four uses of water. [4]

- Domestic, Industrial, Agricultural, Recreational
- *1m each, total 4m*

With the use of specific examples, describe domestic uses of water. [2]

- Domestic uses of water include the use of water for hygiene purposes such as showering; (1m) for consumption such as drinking and cooking. (1m) for household activities like laundry (1m).
- *2 of the 3 to get full marks.*

Describe agricultural uses of water. [3]

- Agricultural uses of water refer to the use of water to water crops, (1m) raise livestock (for rearing for human consumption) (1m), and to cultivate soil. (1m)

Describe industrial uses of water. [3]

- Industrial use of water refer to the use of water to cool equipment in factories to prevent them from overheating; (1m) use of water to generate hydroelectricity; (1m) use of water as raw materials for food and beverages; (1m) use of water as a cleaning agent in water fabrication. (1m)
- *3 out of the 4 to get full marks*

Describe recreational uses of water. [3]

- Water enables people to carry out certain recreational activities such as canoeing; (1m) sailing; (1m) sport fishing; (1m) kayaking; (1m) swimming (1m).
- *3 of the 5 for full marks.*

Suggest one way to reduce water consumption in the household. [1]

- Use water-saving technology such as thimble with reduced water flow. (1m)
- Increase the price of water. (1m)
- *Accept any plausible answers.*

Suggest two reasons to explain the decreasing trend of water usage in Singapore between 2000 and 2030 (projected). [2]

- Greater awareness for the importance of water conservation among residents in Singapore. (1m)
- The cost of water has increased over the years. (1m)
- People are using more water-saving technology at home. (1m)
- *2 out of the 3 for full marks. Accept any plausible answers.*

Define pollution. [2]

- Pollution refers to the introduction of substances into the natural environment (1m) that results in unpleasant or damaging effects to the environment and human health (1m).

Describe three human actions which may lead to water pollution. [3]

- Throwing rubbish into drains/waterways. (1m) Dumping toxic chemical waste into waterway. (1m) Improper management of landfills leading to leakages into waterways. (1m)
- *Accept any other plausible answers*

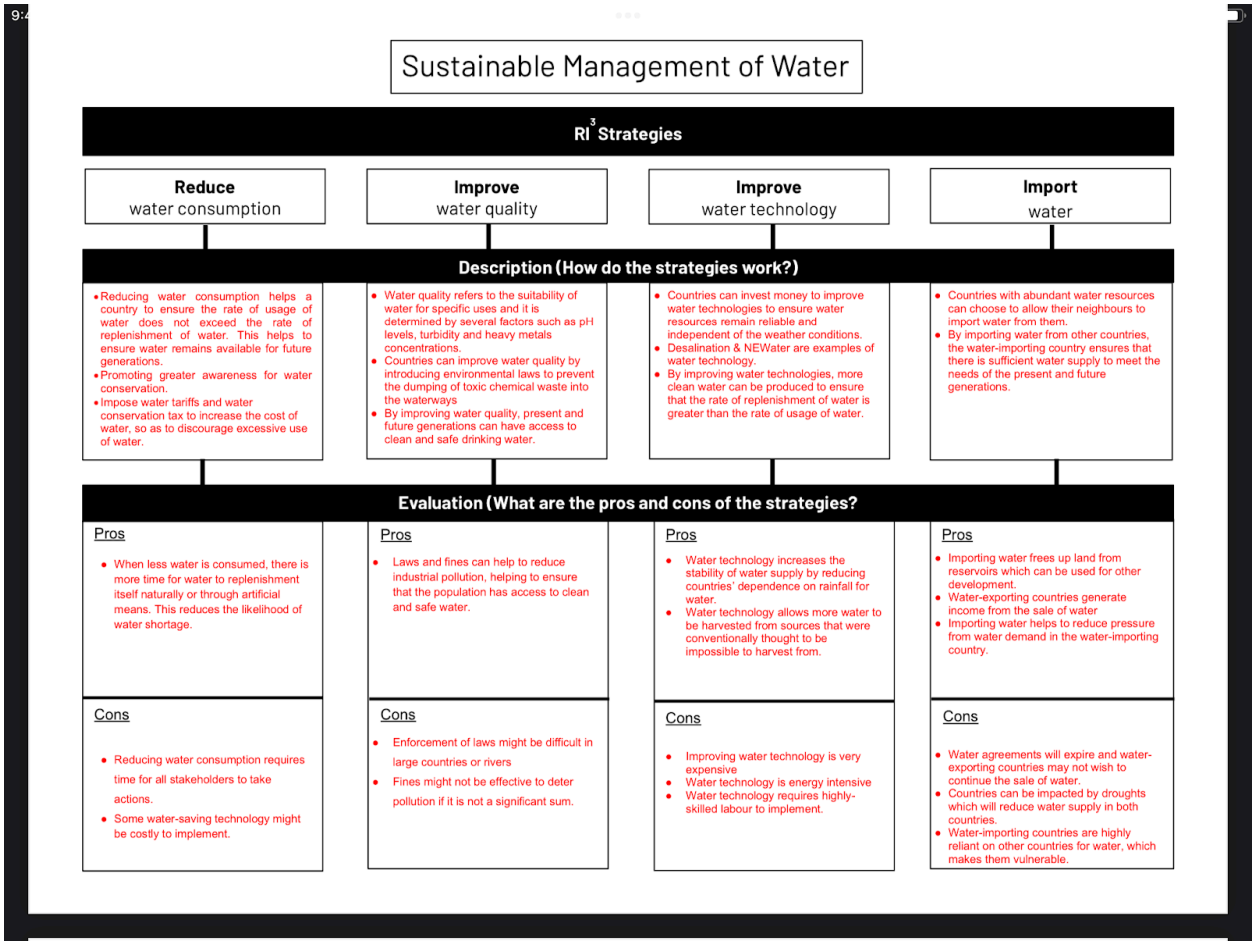
Describe the impacts of water pollution. [2]

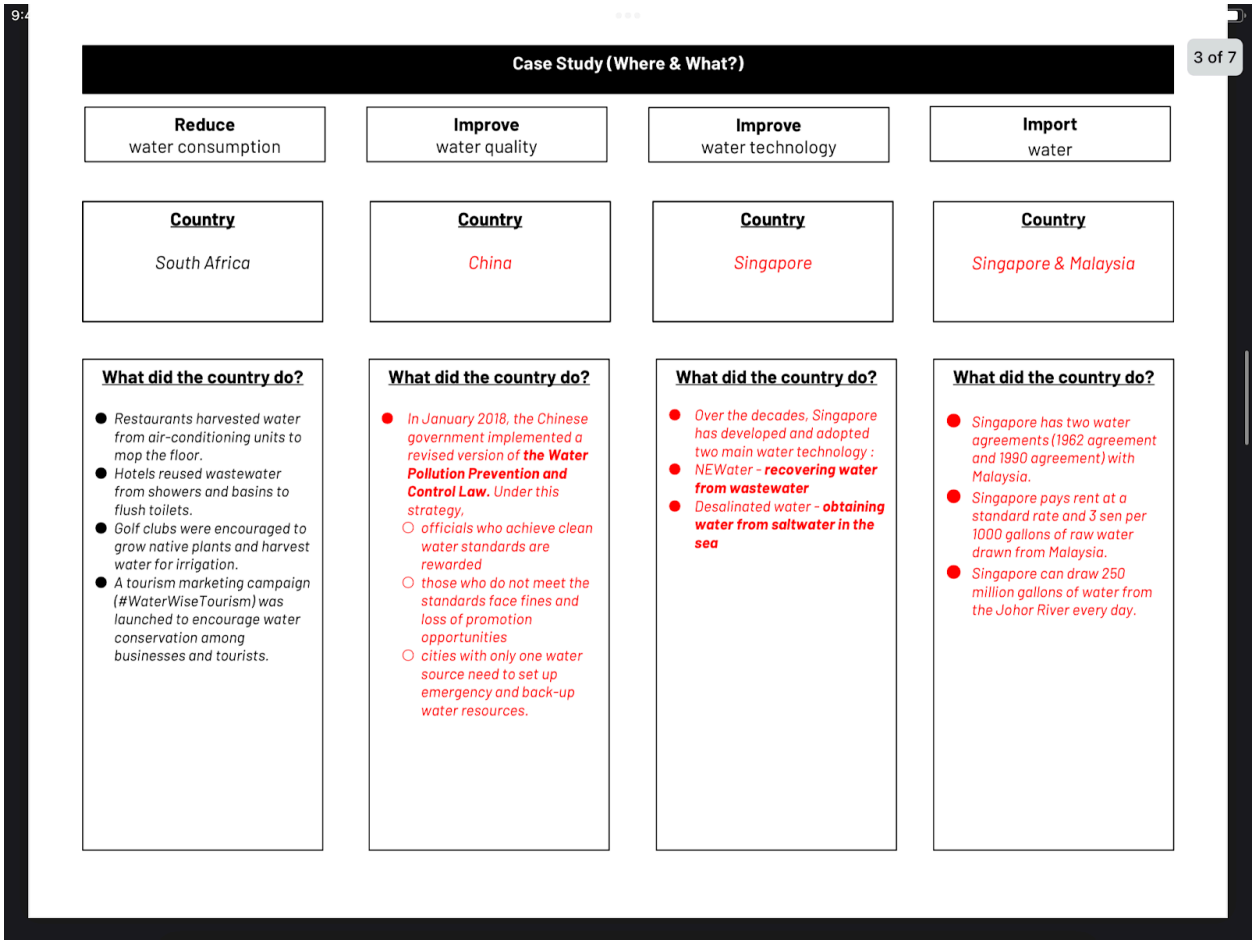
- Water quality will drop; (1m) Aquatic animals and plants may die due to the drop in water quality; (1m) Human health will be endangered. (1m)
- *Any 2 of the 3 to get full marks*

Describe the process of eutrophication. [5]

- Large amounts of fertilizers entering the river/sea through leaching or runoffs provide nutrients for plants and algae to flourish. (1m) Population of algae increases tremendously / algae blooms on the water surface, preventing sunlight from reaching the aquatic plants. (1m) Aquatic plants die due to a lack of sunlight. (1m) Decomposition of dead aquatic animals and plants by the bacteria consumes oxygen in the water. (1m) Other living things in the rivers die due to a lack of oxygen in the water. (1m)

4.3: Sustainable Management of Water





EXAMPLE QUESTIONS:

1. State four strategies to manage water resources sustainably. **[4]**

   - Reduce water consumption
   - Improve water quality
   - Improve water technology
   - Importing water

   1m each

2. Describe four strategies to manage water resources sustainably. **[4]**
   - Reduce water consumption – can be done through **promoting greater awareness for water conservation** OR **imposing water tariffs and water conservation tax** to increase the cost of water, so as to discourage excessive use of water.
   - Improve water quality - Countries can improve water quality by **introducing environmental laws to prevent the dumping of toxic chemical waste** into the waterways
   - Improve water technology - Countries can **invest money to improve water technologies** to **ensure water resources remain reliable and independent of the weather conditions.**
   - Importing water - Countries with **abundant water resources can choose to allow their neighbours to import water from them**

   1m each

3. Explain how Singapore manages its water supply sustainably through improving water technology. **[4]**
   - *Over the decades, Singapore has developed and adopted two main water technology:*
     NEWater - recovering water from wastewater
   - ***Desalinated water - obtaining water from saltwater in the sea***

   2m each

4. Study Extract 1, which describes the role of water tariffs and conservation tax in reducing water consumption in Singapore.

> The water tariff is charged based on the volume of water consumed. The water conservation tax was introduced in 1991 to encourage water conservation and to reflect its scarcity value. From July 2018, people will be charged an additional $2.88 (water tariff and water conservation tax) for every $1m^3$ of water used.

Extract 1

Using evidence from Extract 1, explain how water tariffs and conservation tax can help reduce water consumption in Singapore. **[3]**

- Water tariffs and conservation tax **increases the cost of water**,
- which **discourages people from using water excessively/in a wasteful manner**.
- This can be seen from Extract 1 where **"people will be charged an additional $2.88 for every $1m^3$ of water used".**

1m each, Reserve 1m for the use of evidence

5. Describe the benefits and limitations of importing water from neighbouring countries. **[4]**

Benefits
- Importing water frees up land from reservoirs which can be used for other development.
- Water-exporting countries generate income from the sale of water
- Importing water helps to reduce pressure from water demand in the water-importing country.

Limitations
- Water agreements will expire and water-exporting countries may not wish to continue the sale of water.
- Countries can be impacted by droughts which will reduce water supply in both countries.
- Water-importing countries are highly reliant on other countries for water, which makes them vulnerable.

1m each, 2m for benefits and 2m for limitations

7. Evaluate the effectiveness of improving water quality in increasing water supply in a country. **[4]**

Description of strategy
- Water quality refers to the suitability of water for specific uses and it is determined by several factors such as pH levels, turbidity and heavy metals concentrations.
- Countries can improve water quality by introducing environmental laws to prevent the dumping of toxic chemical waste into the waterways

Advantage
- An advantage of this strategy is that laws and fines can help to reduce industrial pollution, helping to ensure that the population has access to clean and safe water.

Disadvantage
- However, the enforcement of laws might be difficult in large countries or rivers OR Fines might not be effective to deter pollution if it is not a significant sum.

8. Study Fig. 1, which shows a poster published by Public Utilities Board (PUB), Singapore.

Fig. 1

a. Identify the type of water usage shown in Fig. 1. **[1]**
- Domestic/Household

b. Identify the strategy for sustainable management of water shown in Fig. 1. **[1]**

- Reduce water consumption

c. Explain how using a tumbler when brushing teeth can help save water. **[2]**

- It helps to **limit the amount of water used** when brushing teeth.
- It **reduces the wastage of water** which is usually accompanied by brushing of teeth with running tap water.

1m each, Accept any other plausible answers

d. Evaluate the strategy shown in Fig. 1. **[3]**

Advantage

- When less water is consumed, there is more time for water to replenishment itself naturally or through artificial means. This reduces the likelihood of water shortage.

Disadvantage

- Reducing water consumption requires time for all stakeholders to take actions.
- Some water-saving technology might be costly to implement.

1m each

6. Evaluate the effectiveness of using water technology in increasing water supply in a country. **[6]**
*Tip: You need to describe the strategy first before describing **BOTH** pros and cons of this strategy!*

***Describe the strategy**. What is the strategy about?*	• Countries can **invest money to improve water technologies** to **ensure water resources remain reliable and independent of the weather conditions.** • *Examples of water technology include NEWater and desalination.*
***Describe the pros of the strategy.** What are the benefits of this strategy in increasing water supply?*	The advantages of using water technology are: • Water technology increases the stability of water supply by reducing countries' dependence on rainfall for water. • Water technology allows more water to be harvested from sources that were conventionally thought to be impossible to harvest from.
***Describe the cons of the strategy.** What are the limitations of this strategy in increasing water supply?*	The disadvantages of using water technology are: • Improving water technology is very expensive • Water technology is energy intensive • Water technology requires highly-skilled labour to implement.

1m each, 2m for description, 2m for advantages, 2m for disadvantages

5: Spatial Distribution of Tropical Rainforests and Mangroves.

(Natural Vegetation will not be included)

TROPICAL RAINFOREST:

What is the (global) distribution of TRFs? (3m)

- Most of the tropical rainforests are **in between** the Tropic of Cancer and Tropic of Capricorn (1m - General pattern). Tropical rainforests grow **throughout** Southeast Asia, in **Central** Africa and in South America. (1m - Evidence given in the map) These regions experience the **tropical climate** (1m)

*If they ask you for a CONTINENT, (e.g. South America) your answer should be like this:

- The tropical rainforests mostly grow in the **North-East** region of South America, **near the Andes Mountains** (1m - General pattern - can be found in map) They grow in countries like in **Brazil, Peru, Venezuela and Bolivi**a (1m - Evidence - can be found in map) These regions experience the **tropical climate** (1m).

CLIMOGRAPH QUESTIONS:
*Blue means you have to include them in your phrasing if the question ask “tropical climate”

1) (High and constant) Mean annual temperature - add all temperatures for 12 months / 12. (finding average)
2) (Low) Annual temperature range - largest temperature minus smallest temperature.
3) (High) Total annual rainfall - add all rainfall for 12 months
4) Distinct wet and dry seasons - phrase, “there is no distinct wet or dry season - rainfall is uniformly distributed **OR** there is distinct seasons of dry and wet, rainfall is not uniformly distrubuted”

Characteristics:

1) Evergreen nature:
    - Plants do not shed all their leaves at a particular time of the year
    - And Plants continuously grow newer leaves to replace old ones, thus maintaining the green appearance.

2) Structure:
    - They have a distinct, tall, vertical structure
    - Consisting of three main layers of:
      - **Undergrowth (0-20m)** sparse vegetation as not a lot of sunlight can pass through this layer, also comprises of a dense layer of decomposing matter.

      - **Canopy (20m-30m)** crowns of trees that grow up to 20m-30m interlock with each other to form a near-continuous mass of branches and leaves.

- **Emergent (30m-50m)** tall and isolated trees that can grow up to 50m which competes for sunlight.

(IMPORTANT FOR 'STATE' AND 'DESCRIBE' questions for layers)

3) Diversity:
    - Rich biodiversity with a large number of plant and animal species.

Adaptations:

LEAVES:

1) **Broad leaves:** has a larger surface area to absorb more sunlight, maximizing rate of photosynthesis.

2) **Waxy leaves:** (1) allows rainwater to flow off easily preventing the growth of fungi and bacteria. (2) prevents the loss of water vapour through transpiration because of the hot climate.

3) **Drip tips:** allows rainwater to flow off easily preventing the growth of fungi and bacteria.

ROOTS:

1) **Buttress roots:** provides support for tall trees (usually emergent), keeping them upright so as to prevent them from falling over.

2) **Shallow, wide spreading roots:** absorb nutrients and water concentrated in the topsoil. ***(TRFs do not have to grow tap roots to absorb water deep in the ground)***

MANGROVES:

What are mangroves? - trees that grow near the sea….

What is the global distribution of mangroves? (3m)

- **Most** of the mangroves reside i**n between** the Tropic of Capricorn and the Tropic of Cancer and **in sheltered coastal environments like river mouths** (1m - General Pattern). These regions include **northern** coast of **Australia, coasts of South America and Southeast Asia** (1m - Evidence from the map) However, there are some mangroves that **reside outside of the tropics** like on the **coasts of North New Zealand and the Eastern Coast of Australia** (1m - Anomaly) These places experience the tropical climate (Just write)

Why do mangroves live in sheltered coastal environments? (4m)

- There is **high salinity** in sheltered coastal environments (1m) which means there is **a lack of competition** for the mangroves (1m). **Calm water conditions** encourage the **accumulation of fine sediments, containing nutrients**, which mangroves **need to sustain their growth** (1m) They also need calm water conditions **so their seedlings can take root and grow without being washed away by the strong waves** (1m)

Characteristics:

1) Evergreen nature
    - Plants do not shed all their leaves at particular times of the year
    - And they continuously grow new leaves replacing the old ones, thus maintaining a green appearance.

2) Structure
    - They are **relatively uniform in height** - with no distinct vertical structure
    - They have **horizontal zonation**, where;
      - more salt tolerant species are found nearer to the low-tide level **(e.g. Sonneratia > Avicennia)**
      - less salt tolerant species are found nearer to the high-tide level **(e.g. Rhizophora > Bruguiera)**

      (SPECIES MUST REMEMBER)

3) Diversity
    - Less diversity - a smaller variety of plant and animal species compared to the tropical rainforest.

Adaptations:

LEAVES:

1) ~~Broad leaves~~
2) Waxy leaves
3) Drip Tips
4) Salt-secreting leaves: (1) to remove excess salt out of the saline water absorbed. Salt on the leaves' surface will get removed by wind or rain. (2) [Sonneratia] they transfer the excess salt to old leaves which eventually shed, making it so that salt does not build up within the plant. .

ROOTS:

1) Aerial roots: like prop roots, knee-bend roots, pencil roots and cone roots help to anchor the mangroves into the soft and oxygen-poor soil, and also takes in oxygen directly from the air.

2) Salt-excluding roots: do not absorb the salt from the saline water.

Chapter 6: Sustainable Management of TRFs and Mangroves

6.1: Functions

Erosion protection (hard)
Carbon storage (easy)
Habitat for diverse animal life (medium)
Oxygen production

STATE VS DESCRIBE/EXPLAIN
- state four
- describe/explain one

STATE questions:
State what are the environmental functions of TRF? [4]
- Erosion protection, Carbon Storage, Habitat for diverse animal life, oxygen production (4m)
- *Each is one mark*

DESCRIBE/EXPLAIN questions:

Erosion protection questions

Describe how tropical rainforests can reduce soil erosion. (Testing on erosion protection for TRF) [4]
- The trees have a **protective** cover over the ground surface, (1m) and **intercept** falling raindrops, **slowing** them down (before they hit the ground). (1m) The raindrops hit the soil with **less** force, **more** rainwater can **infiltrate and percolate** the soil. (1m) This reduces the amount of **surface runoff** (1m) and as the **roots bind the soil together** (1m) makes it harder for the soil to erode.
- *Any 4 out of the 5 to get full marks.*

Describe how mangroves can reduce coastal erosion. (Testing on erosion protection for Mangroves) [4]

- Mangroves prevent coastal erosion by **stabilising** the soil and **reducing** the energy of strong waves and storms. (1m) The **dense** root system of the mangrove plants help to **trap and stabilise** loose sediments on the coast. (1m) This reduces the likelihood of the sediments being washed away by waves, currents and tides. (1m) The roots, trunks and branches of mangrove plants cause **friction** with waves hitting the coast, (1m) **reducing** the wave energy and coastal erosion.

Carbon storage questions

Describe the role of TRFs as carbon storages. [4]

- They absorb **carbon dioxide during photosynthesis** (1m - describing how they store carbon), storing the carbon in **solid** form (1m - describing how they store carbon). Dead leaves and branches (that fall onto the ground) **decompose** and **add** carbon to the **soil** (1m - describing how they store carbon). This helps to **regulate** the amount of carbon dioxide in the atmosphere, ensuring a **balance** in carbon dioxide concentration (in the atmosphere). (1m - explaining their role as carbon storage)

Habitat for diverse animal life questions

Describe TRFs being a habitat for diverse animal life [2-3]

- Tropical rainforests and mangroves are **rich in biodiversity** (1m). The **warm** climate and the **abundance of food and water sources all year round** (1m) make them **suitable** habitats for a wide variety of plants and animals (or flora and fauna). (1m)

Oxygen production questions

Explain the importance of forests as the “Green Lungs” of Earth. [3]

- Tropical rainforests and mangroves **generate (or produce) oxygen through (or via) photosynthesis**.(1m) Tropical rainforests produce **forty** percent of all the oxygen in the atmosphere due to their **evergreen** nature as they are **capable of photosynthesizing all year round**. (1-2m)

**DO NOTE QUESTIONS MAY BE PHRASED DIFFERENTLY, SO YOU MUST KNOW HOW TO IDENTIFY THEM!*

6.2: Uses

Places of Recreation (usually tested)
Places of Habitation
Source of Food
Source of Raw Materials

Habitation, Food and Raw Materials are usually combined to form one question like “explain the importance of TRFs to the indigenous”

STATE VS DESCRIBE

- state four
- describe four (not in detail)
- describe one (in detail)

STATE questions:

State what are the uses of TRF? [4]

- Places of recreation, places of habitation, source of food, source of raw materials (4m)
- *Each is one mark*

DESCRIBE/EXPLAIN questions:

Places of Recreation questions

Explain why TRFs are suitable for recreation. [4]

- Tropical rainforests are **recreational sites** for people who live in towns and cities to **get close to nature**. (1m) **Trekking, hiking, camping, and birdwatching** are some common activities that people do. (1m) Visiting tropical rainforests has a **positive effect** on people's health. (1m - overall on health) The **natural sights, sounds and smells** of the forest have a **calm** effect on people, which helps to give them a **sense of well-being**. (1m - mental health) People can also visit tropical rainforests to **exercise and lead an active lifestyle**. (1m - physical health)
- *Any 4 of the 5 to get full marks.*

Places of Habitation questions

Describe how TRFs are places of dwellings. [2-3] (Testing on habitation)

- Tropical rainforests are places of **dwellings** for **indigenous** people. (1m) They depend on the physical environment to meet their **basic needs such as food, water, shelter, and clothing.** (1-2m)

Source of Food questions

Describe how the indigenous get food in TRFs. [2-3] (Testing on food source)

- Tropical rainforests are an important source of **food** for **the indigenous** (normally it is 'people' but you change to 'the indigenous' to ATQ) (1m) **Hunter-gatherer societies** like the indigenous often hunt **wildlife** such as fish and deer for food. (1-2m)

Source of Raw Materials

Describe how TRFs are sources of raw materials. [2-3]

- Tropical rainforests are valuable sources of raw materials and wood for **building and carpentry** (or furniture.) (1-2m) Tropical rainforests also contain **minerals** and **metals**, which are found underneath the forest. (1m)

Example of all three above being combined: Application question

Describe the importance of TRFs to the indigenous. [3-4]

- Tropical rainforests are places of dwellings (1m) for the indigenous where they can get their basic needs like food, water, shelter, and clothing. The indigenous get food as they are hunter-gatherer societies who hunt wildlife like deer and fish. (1m) The indigenous can build their shelter using the timber found in the tropical rainforests. (1m) The tropical rainforests are also valuable sources of raw materials like minerals and metals which are found underneath the forest. (1m)
- *If three marks, any 3 of the 4 to get full marks.*

Describe four (not in detail) questions:

Describe the four uses of TRFs.

- Places of Recreation: Tropical rainforests are places of recreation where people can interact with nature to improve their overall health. (1m)
- Places of Habitation: Tropical rainforests are places of dwellings for the indigenous. (1m)
- Source of Food: Tropical rainforests are an important source of food for the people and indigenous. (1m)
- Source of Raw Materials: Tropical rainforests are valuable sources of raw materials like timber, minerals, and metals. (1m)

**DO NOTE QUESTIONS MAY BE PHRASED DIFFERENTLY, SO YOU MUST KNOW HOW TO IDENTIFY THEM!*

6.2b: **D**eforestation & **E**nhanced **G**reenhouse **E**ffect

Deforestation

- the permanent removal of forest cover in a specific area. (If definition is tested, the question is 1m)
- **Why does it occur:** unsustainable cutting down of trees for wood mining, agriculture and aquaculture.
- **Impacts:** lack of biodiversity and resources, enhanced greenhouse effect.

Enhanced **G**reenhouse **E**ffect

- warming up of the Earth's surface as a result of additional carbon dioxide released into the atmosphere as a result of human activities. (If definition is tested, the question is 2m)

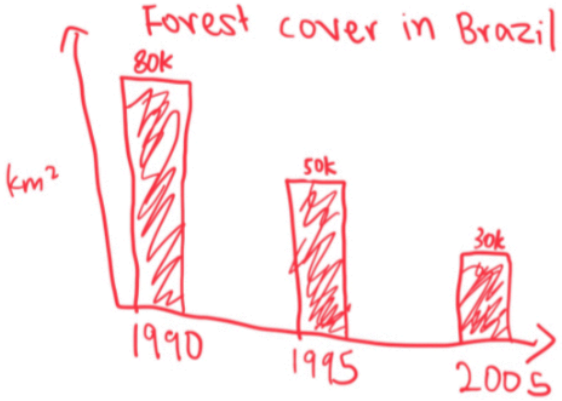
- **Greenhouse gases**: carbon dioxide, nitrous oxide, methane, water vapour (can be tested, each is 1m)
- **Why does it occur:** deforestation, using fossil fuels (all human activities)
- **Impacts:** unpredictable and extreme weather events like storms and droughts.

e.g. Question for **E**nhanced **G**reenhouse **E**ffect:

What's the difference between "greenhouse effect" and "enhanced greenhouse effect"? [2]

- Greenhouse effect is the natural warming of Earth as a result of greenhouse gases (1m) but enhanced greenhouse effect is the warming up of the Earth as a result of additional greenhouse gases emitted into the atmosphere due to human activities. (1m)

Graph Questions:
Use **Trend, Date (Time), Data** to answer change questions in graphs
e.g. Question:



What's the change between forest cover in Brazil from 1990 to 2005? [3]

The forest cover has decreased from 1990 to 2005 in Brazil. [1] (Trend)
(Time + Data) In 1990, there was 80,000 km² of forest cover in Brazil. [1]
(Time + Data) In 2005, there was 30,000 km² of forest cover in Brazil, so
(Explaining your Data) there's an overall decrease of forest cover by 50,000 km². [1]

Do note that if there's fluctuation, you need to state the OVERALL trend (with data), and the Time and Date for all fluctuations. Questions with fluctuations usually will be 4m.

More difficult questions to tackle:

DIFFICULT QUESTION

may be ohian...

Explain why there's fluctuations in the monthly mean CO_2 concentrations? [2]

explains decrease { - Since Hawaii is in the Northern Hemisphere, it experiences higher temperatures around June, so there's lower carbon dioxide levels due to more intense rate of photosynthesis [1]

explains increase { During the cooler season towards December, photosynthesis cannot take place, so plants cannot absorb CO_2, so there's a higher mean CO_2 concentration from June to the end of year. [1]