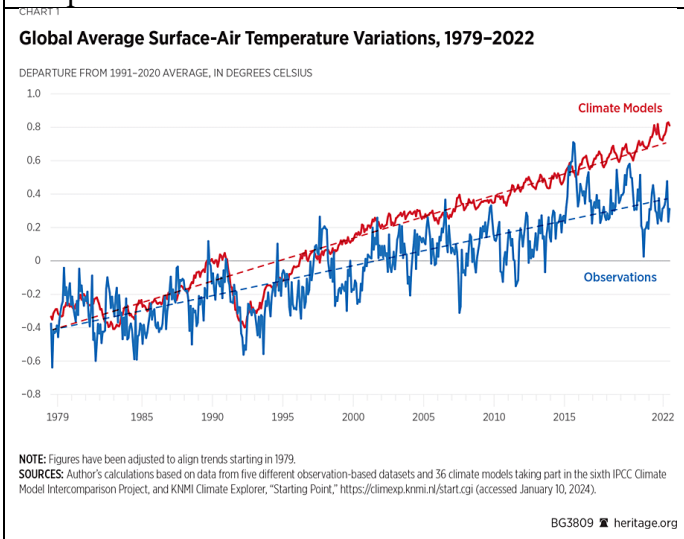
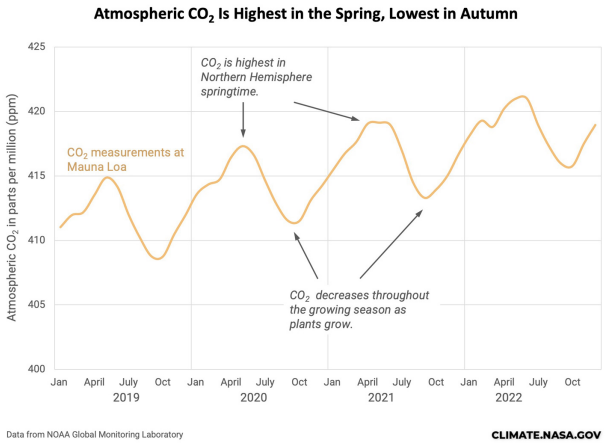
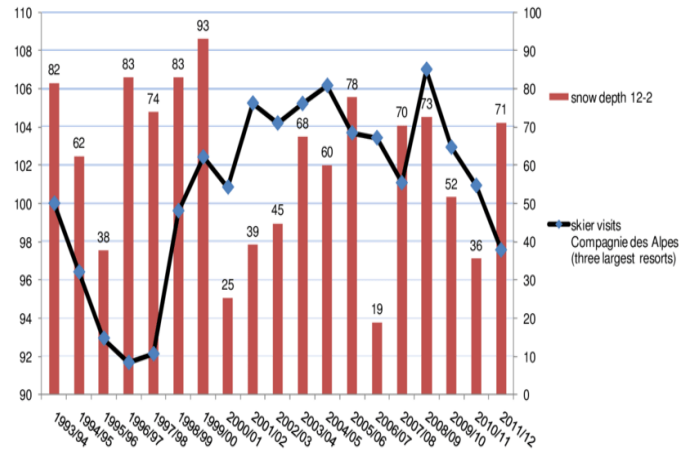
Analytical Skills in ESS

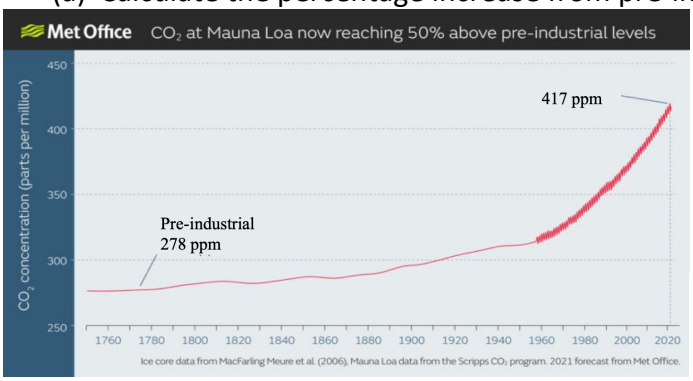
1. Describing Graphs

Describe the following graphs

Graph	Description
	• Both, observation and climate models data show a variable pattern of increasing air temperature variation; • The highest observed temperature change was approximately +0.7°C recorded in around 2016; • The lowest observed temperature change was approximately -0.65~°C recorded in around 1979;
	• Variable annual CO_2 ppm change with a slight overall increase from 2019 to 2022; • The CO_2 ppm decreases annually from spring to autumn; • The CO_2 ppm increases annually from autumn, around Oct, to late spring up to around May
	• No observable correlation between skier visits and snow depth, although a weak positive correlation can be observed between 2000/01 and 2003/04; • In overall, skier visits and snow depth show variable data; • There is an overall increase in skier visit from 1996/97 to 2004/05; • Lowest snow depth recorded was 19, in 2006/07;

2. Calculating percentages

(a) Calculate the percentage increase from pre-industry to 2020



$$\frac{417 - 278}{278} \times 100 = 50\%$$

(b) With reference to the data in Figure 4(a), calculate the percentage of the world's coral species found in the Coral Triangle.

Figure 4(a): Species within the Coral Triangle

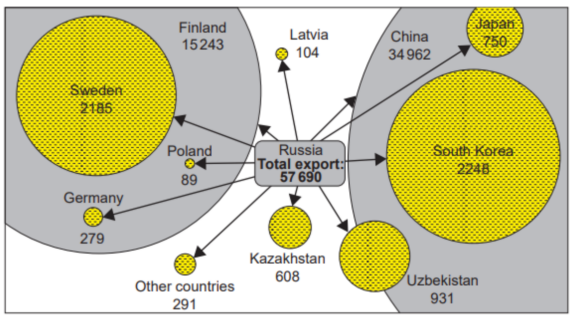
	Number within Coral Triangle	Global number
Coral species	605	798
Coral reef fishes	2228	6000
Marine turtles	6	7
Whale, dolphin and porpoise species	29	92

[Source: adapted from http://wwf.panda.org and www.marinespecies.org]

$$\frac{606}{798} \times 100 = 76\%$$

(c) With reference to **Figure 7(b)**, calculate the percentage of timber exports to China between the years 2012–2014

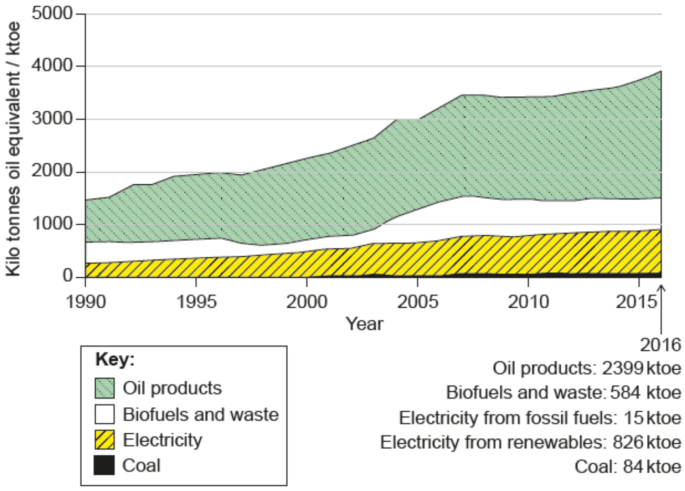
Figure 7(b): Total exports of timber (in units of thousand cubic metres) from Russia between 2012 and 2014



[Source: With permission from GRID-Arendal. Source adapted.]

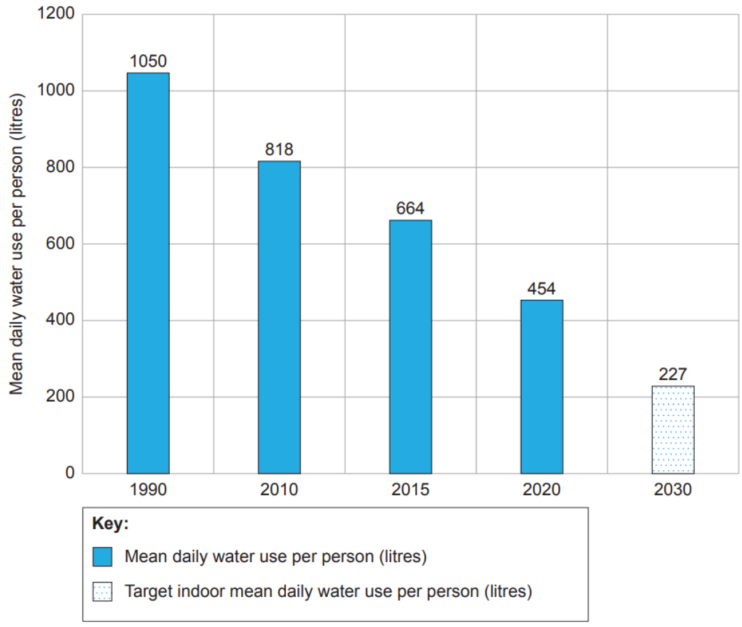
$$\frac{34\,962}{57\,690} \times 100 = 61\%$$

(d) Calculate the percentage of energy consumed that came from fossil fuels in 2016.



$$\frac{2498}{3908} \times 100 = 64\%$$

Figure 6(c): Mean daily water use (in litres) per person in California



(e) calculate the percentage decrease in mean daily water use per person between 1990 and 2020.

$$\frac{454 - 1050}{1050} \times 100 = -57\%$$

Therefore, 57% decrease

Theoretical Skills

1. Outline the distinctive characteristics of EVSs

Ecocentric	Anthtopocentric	Technocentric
• nature/ecosystems should be left alone with minimal interference / deep ecologist; • self-reliant communities (population controlled by carrying capacity) / use of small-scale technology; • self-imposed constraint in resource use; • holistic world view / spiritual dimensions to natural systems/intrinsic value / prioritizes bio-rights	• Sustainable management is a duty of human societies / environmental manager; • Population control given equal weight to resource use; • Strong legal regulation by authorities / imposing environmental taxes, fees, compensations; • It is moral for human societies to benefit from natural capital; • Encourages debate to reach a consensual, pragmatic approach to solving environmental problems;	• believes technological developments can provide solutions to environmental problems; • provides an optimistic view of the role humans can play in improving the lot of humanity; • encourages scientific research in order to form policies and to understand how systems can be controlled, manipulated or changed to solve resource depletion; • sees a pro-growth agenda as necessary for society's improvement / believes that economic growth can be sustained without environmental harm;

2. Outline 2 factors influencing someone's value

Lived experience – develops someone's value based on their exposure to different environmental events such as those experienced a natural disaster may become ecocentric to prevent further worsening of the natural disasters
Scientific discovery – develops new knowledge and evidences about certain environmental topics. For example, the first photograph of the Earth shifted people's perspective about the need to safeguard the Earth

3. Question 3 is based on this figure:

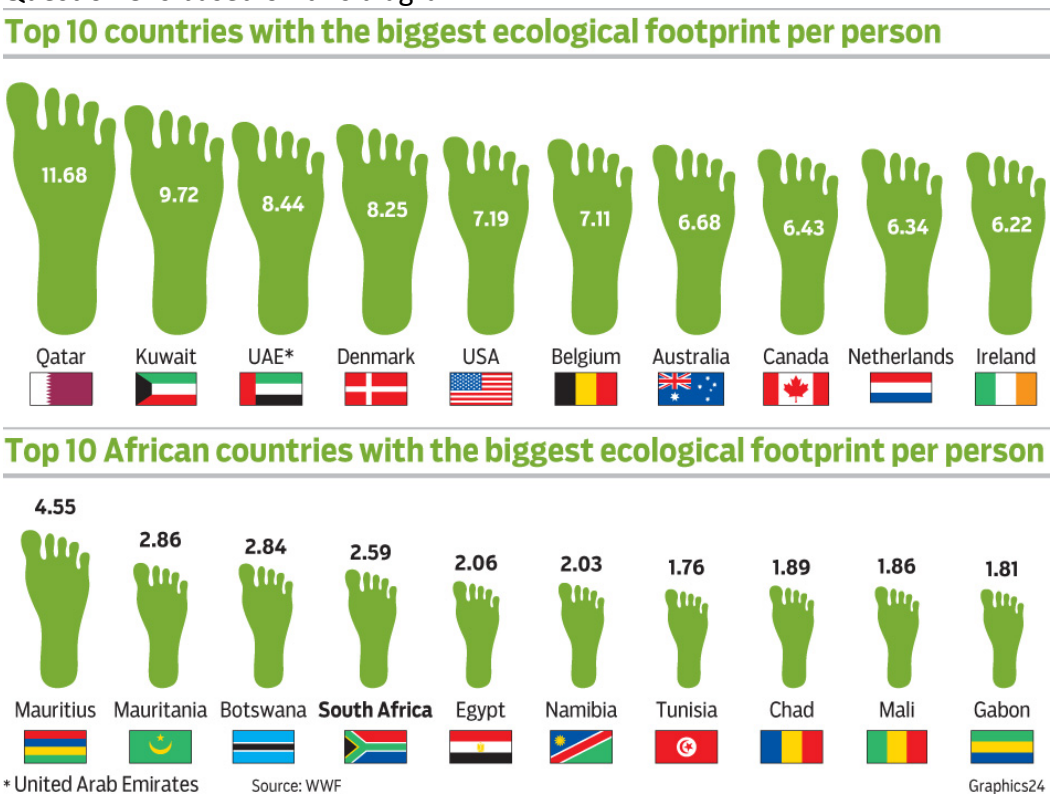
(a) State the type of system shown in the photograph above

Open soil system

(b) Identify 2 transfers and 2 transformations in the above system

Transfer: (1) Soil matter added into the pot. (2) Watering the plant transfers water into the system
Transformation: (1) Decomposition by bacteria in the soil. (2) Evaporation of water from the surface of the soil

4. Question 5 is based on this diagram



(a) Define ecological footprint

is the area of land and water required to sustainably provide all the resources required at the rate of consumption and to assimilate all wastes at the rate of production by a given population.

(b) Explain why the EF values are different between nations

- Smaller populations use fewer resources/produce less waste (for total EF);
- Laws/education campaigns to promote recycling/reducing waste/using fewer resources;
- More productive biomes can absorb more waste per km^2;
- Culture/EVS/lifestyles that promotes sustainability will use fewer resources/produce less waste;
- High level of technology/resources for more sustainable energy generation/waste disposal options;
- Low economic means so can't afford resources;
- Low levels of industrialization so fewer resources used/less waste produced;

5. Describe a positive feedback loop involving methane and a negative feedback loop involving albedo effect

Positive feedback loop of CH_4	Negative feedback loop
• Atmospheric temperature is high due to high concentration of GHGs including methane • Permafrost melts, releasing methane gas that was trapped under it • More GHGs in the air • Atmospheric temperature increases further, causing even more permafrost to melt	• High temperature increases evaporation rate • More clouds are formed • Clouds can reflect sun's radiation. • More clouds formation increases the albedo effect • The temperature decreases

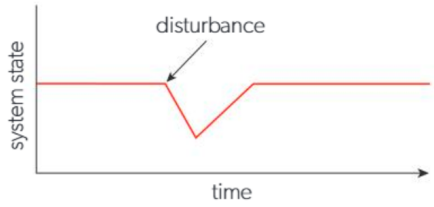
6. Outline the effect of crossing the tipping point

Tipping point is the critical point in which if a system crossing it, it will trigger the system to shift to a new equilibrium

7. Outline 2 ways to increase a system's resilience

Increase genetic diversity can offer resilience towards diseases. Which means, a disease outbreak would not be affecting the population largely or easily;
Size of ecosystem – larger ecosystems would contain more biodiversity in terms of species, genetic and habitat. This means that different species may be able to support each other should a small external factor disturbs then system

8. Sketch a graph illustrating a resilient system that had just experienced a small disturbance



9. Define sustainability and sustainable development

Sustainability refers to using global resources at a rate that allows natural regeneration while minimizing environmental harm. For example, harvesting renewable resources at a pace where natural growth can replace them demonstrates sustainability.

Sustainable development, on the other hand, is about meeting present needs without jeopardizing the ability of future generations to meet their own. It is often harder to define, as different groups highlight different priorities.

The main distinction is that sustainability emphasizes the rate of resource use, while sustainable development refers to a broader approach to progress and growth. Sustainability focuses on maintaining balance and equilibrium, whereas development implies progress, change, and improvement.

Sustainability also has a broader scope, extending beyond "development" itself—for instance, influencing personal lifestyles or the management of specific farms.

10. Outline three pillars of sustainability

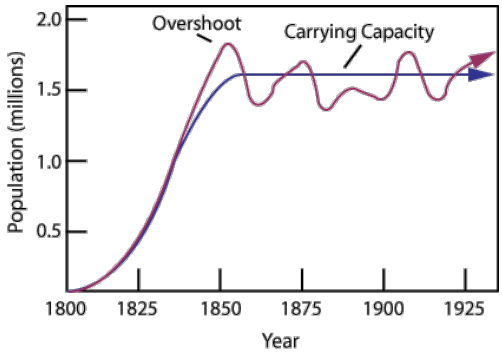
Environmental	Social	Economics
Aims to protect the environment to ensure its sustainability	Aims to promote equity, justice, and well-being in communities. This emphasises on the right for every person to access clean and healthy environment	Aims to ensure long-term economic growth without harming the environment or society.

11. Outline 3 factors leading to inequalities

Access	Abundance	Technology
Some countries have easy access to more natural resources than others.	There is inequality in the quantity of resources available to different countries. Some countries have abundant resources and others do not.	The ability of a country to develop technological solutions and to deliver food, water and energy throughout its population will affect direct access to key resources.

12. Define the term biocapacity, carrying capacity and ecological overshooting. Use a graph to represent them

- Carrying capacity is the maximum number of individuals of a species that the environment can sustainably support;
- Biocapacity is the capacity of a biologically productive area to generate a supply of renewable resources and to absorb its waste;
- Ecological overshooting refers to a situation when humanity's demand for natural resources and ecogical services (like food, water, timber, carbon absorption) exceeds the Earth's capacity to regenerate them within a given year.



13. Explain how anthropocentric and ecocentric value systems influence how soil resources are managed.

Ecocentric description [2 max]:

- integrates social, spiritual and environmental dimensions into a holistic ideal;
- puts ecology and nature as central to humanity / prioritizes biorights;
- emphasizes a less materialistic approach to life / encourages self-restraint in human behaviour;
- encourages greater self-sufficiency of societies / community action;
- emphasizes the importance of education;

Ecocentric soil management:

- soil should be disturbed as little as possible / working with nature should be prioritized;
- organisms in the soil should be protected;
- farmers/citizens should be educated in soil conservation/sustainable practices;
- use of cooperatives/community action in soil conservation;
- creation of protected/soil conservation areas;

Anthropocentric description: [2 max]

- An anthropocentric viewpoint argues that humans must sustainably manage the global system;
- This might be through the use of taxes, environmental regulation and legislation;
- Debate would be encouraged to reach a consensual, pragmatic approach to solving environmental problems;

Anthropocentric soil management:

- Quotas/bans may be set regarding quantity/type of fertilisers/pesticides used;
- Unsustainable farming practices e.g. monocropping may be outlawed;
- Incentives may be provided for sustainable farming practices/soil conservation methods / e.g. terracing, crop rotation, organic fertilization;

Note to examiners: Award [4 max] per EVS. Credit any valid statement and any statement of equivalent significance and validity.