1. What is the environment? Environment components and functions.

The environment refers to the surroundings or conditions in which living organisms exist. It encompasses various components and functions that interact and influence each other. Here are the key components and functions of the environment

Components of the Environment:

1. Atmosphere: The layer of gases surrounding the Earth, primarily composed of nitrogen, oxygen, carbon dioxide, and other trace gases.
2. Hydrosphere: All forms of water on Earth, including oceans, rivers, lakes, groundwater, and ice.
3. Lithosphere: The solid outer layer of the Earth, including the Earth's crust and the uppermost part of the mantle.
4. Biosphere: The part of the Earth that supports life, including all living organisms—plants, animals, and microorganisms.

Functions of the Environment:

1. Habitat: The environment provides a habitat or home for living organisms. Different species have specific requirements for survival, such as temperature, food, water, and shelter.
2. Nutrient Cycling: The environment facilitates the cycling of nutrients through processes such as decomposition, nutrient absorption by plants, and consumption by animals.
3. Energy Flow: Energy flows through ecosystems, starting with primary producers (plants) that capture sunlight and convert it into chemical energy through photosynthesis.
4. Climate Regulation: The environment plays a crucial role in regulating climate patterns through interactions between the atmosphere, hydrosphere, and biosphere.
5. Ecological Balance: The environment maintains a delicate balance of interdependent relationships among organisms, preventing the dominance of any single species.
6. Natural Resources: The environment provides various resources essential for human survival and development, including water, air, minerals, forests, and agricultural land.

2. Describe your knowledge of natural resources and the flow of natural resources in the economic system.

Natural resources are materials or substances that occur naturally in the environment and are used by humans for various purposes. They can be classified into three main categories:

1. Renewable Resources: These are resources that can be replenished or regenerated naturally within a reasonable time frame.
2. Non-Renewable Resources: These are resources that exist in limited quantities and cannot be replenished within a human-relevant time scale.
3. Recyclable Resources: These resources can be reused or reprocessed after their initial use, reducing the need for extracting new resources.

The flow of natural resources in the economic system involves several interconnected processes:

1. Extraction: Natural resources are extracted from the Earth through mining, drilling, logging, fishing, or other methods.
2. Processing: Once extracted, natural resources often need processing to refine, purify, or transform them into products that can be used by industries or consumers
3. Manufacturing: Processed resources are then used as inputs in manufacturing processes to produce goods and products.
4. Distribution: Finished goods are distributed and transported to markets for sale and consumption.
5. Consumption: Consumers purchase and use the goods and products made from natural resources in their daily lives. This stage represents the utilization and final use of resources.
6. Waste Management: After consumption, products may become waste. Proper waste management practices, including recycling, reusing, and responsible disposal, aim to minimize the environmental impact of resource consumption and reduce the need for extracting new resources.

3. Describe your knowledge of air pollution (definition, sources, some main pollutants)

Air pollution refers to the presence of harmful substances in the Earth's atmosphere, resulting in adverse effects on human health, ecosystems, and the environment as a whole. It is primarily caused by the release of pollutants into the air through various human activities and natural processes. Here's an overview of air pollution, its sources, and some main pollutants:

Definition: Air pollution refers to the contamination of the air with pollutants, which can be in the form of gases, particulate matter, or biological agents. These pollutants can be emitted directly into the air (primary pollutants) or formed through chemical reactions in the atmosphere (secondary pollutants).

Sources of Air Pollution:

1. Industrial Emissions: Industrial processes such as manufacturing, power generation, and construction activities release pollutants into the air
2. Transportation: Vehicles, including cars, trucks, and planes, emit pollutants such as nitrogen oxides, carbon monoxide, particulate matter, and volatile organic compounds.
3. Power Generation: The combustion of fossil fuels in power plants to generate electricity releases pollutants like sulfur dioxide, nitrogen oxides, carbon dioxide (a greenhouse gas), and particulate matter.
4. Residential and Commercial Activities: Burning solid fuels (such as wood and coal) for heating and cooking in households and commercial establishments can release pollutants into the air, including particulate matter, carbon monoxide, and volatile organic compounds.
5. Agricultural Practices: Agricultural activities involve the use of fertilizers, pesticides, and burning of agricultural waste, which can release ammonia, methane, and dust particles into the air.
6. Natural Sources: Natural processes such as volcanic eruptions, dust storms, wildfires, and biological decay also contribute to air pollution by releasing pollutants like sulfur dioxide, ash, smoke, and pollen.

Main Air Pollutants:

1. Particulate Matter (PM): It refers to tiny particles suspended in the air, including dust, soot, smoke, and liquid droplets.
2. Nitrogen Oxides (NOx): These are produced during the combustion of fossil fuels, primarily in vehicles and power plants.
3. Sulfur Dioxide (SO2): It is primarily emitted by the burning of fossil fuels, particularly in power plants and industrial processes.
4. Carbon Monoxide (CO): This colorless and odorless gas is emitted by the incomplete combustion of fossil fuels in vehicles and industries.
5. Volatile Organic Compounds (VOCs): These are released by various sources, including industrial processes, vehicle emissions, solvents, and certain household products.
6. Ozone (O3): While ozone in the stratosphere is beneficial in protecting the Earth from harmful ultraviolet radiation, ground-level ozone is a pollutant.

4. Describe your knowledge of water pollution (definition, sources, some main pollutants)

Water pollution refers to the contamination or degradation of water bodies, including rivers, lakes, oceans, groundwater, and other sources of water. It occurs when harmful substances, pollutants, or contaminants are introduced into water sources, leading to negative impacts on aquatic ecosystems, human health, and the environment. Here's an overview of water pollution, its sources, and some main pollutants:

Definition: Water pollution refers to any physical, chemical, or biological changes in water quality that make it harmful or undesirable for its intended use. It can result from various human activities, industrial processes, agriculture, and natural sources.

Sources of Water Pollution:

1. Industrial Discharges: Industries release pollutants into water bodies through their effluents.
2. Municipal and Household Wastewater: Wastewater from households, sewage systems, and wastewater treatment plants contains contaminants, including pathogens, nutrients, pharmaceuticals, and chemicals.
3. Agriculture Runoff: The use of fertilizers, pesticides, and animal waste in agricultural practices can lead to water pollution.
4. Mining Activities: Mining operations can release harmful chemicals and heavy metals into nearby water bodies.
5. Oil Spills: Accidental oil spills from oil tankers, offshore drilling rigs, or pipelines can cause significant water pollution.
6. Atmospheric Deposition: Airborne pollutants, such as sulfur compounds, nitrogen oxides, and particulate matter, can be deposited onto water surfaces through rainfall or dry deposition.

Main Water Pollutants:

1. Nutrients: Excessive amounts of nutrients, mainly nitrogen and phosphorus, can lead to eutrophication in water bodies.

2. Heavy Metals: Toxic metals like mercury, lead, cadmium, and arsenic can enter water bodies through industrial discharges, mining activities, and improper waste disposal.
3. Pathogens: Water can become contaminated with disease-causing microorganisms, including bacteria, viruses, and parasites, through sewage discharge or inadequate wastewater treatment.
4. Chemical Pollutants: Various chemicals, including pesticides, herbicides, industrial solvents, pharmaceuticals, and synthetic compounds like PCBs and dioxins, can contaminate water sources.
5. Sediments: Soil erosion from construction sites, agricultural fields, and deforestation can lead to sedimentation in water bodies.
6. Thermal Pollution: The release of heated water from industrial processes or power plants into water bodies can alter water temperatures, affecting aquatic organisms and reducing oxygen levels.

5. Describe your knowledge of the ecosystem (definition, structure, types, and causes of ecosystem degradation). Give an example of a food chain/ food web.

An ecosystem is a complex community of living organisms (biotic factors) interacting with their physical environment (abiotic factors) in a particular area. It involves the flow of energy and the cycling of nutrients among different organisms and their surroundings. Here's an overview of ecosystems, including their definition, structure, types, causes of degradation, and an example of a food chain/food web:

Definition: An ecosystem refers to a dynamic and interconnected system in which organisms, their physical environment, and their interactions shape the functioning and balance of the system. It includes both biotic components (such as plants, animals, and microorganisms) and abiotic components (such as soil, water, air, and climate).

Structure of Ecosystem: Ecosystems consist of several structural components:

1. Producers: These are autotrophic organisms, typically plants or photosynthetic bacteria, that convert energy from the sun into organic matter through photosynthesis.
2. Consumers: These are heterotrophic organisms that obtain energy by consuming other organisms.
3. Decomposers: Decomposers, mainly bacteria and fungi, break down dead organic matter and waste materials, releasing nutrients back into the ecosystem for reuse by producers.
4. Abiotic Components: The abiotic components of an ecosystem include soil, water, air, sunlight, temperature, rainfall, and other physical factors that influence the distribution and functioning of organisms within the ecosystem.

Types of Ecosystems: Ecosystems can be categorized into various types based on their characteristics and geographical locations:

1. Terrestrial Ecosystems: These include forests, grasslands, deserts, tundra, and other land-based ecosystems.

2. Aquatic Ecosystems: These include freshwater ecosystems such as rivers, lakes, and wetlands, as well as marine ecosystems such as oceans, coral reefs, and estuaries.
3. Human-Modified Ecosystems: These are ecosystems that have been significantly altered by human activities, such as urban areas, agricultural lands, and industrial sites.

Causes of Ecosystem Degradation: Ecosystem degradation refers to the decline in the health, integrity, or functioning of an ecosystem. Some common causes include:

1. Habitat Loss and Fragmentation: The conversion of natural habitats into agricultural land, urban areas, or industrial zones leads to habitat loss and fragmentation, disrupting the balance of ecosystems and causing a decline in biodiversity.
2. Pollution: The release of pollutants into ecosystems, including air, water, and soil pollution, can harm organisms, disrupt food chains, and degrade ecosystem health.
3. Overexploitation: Unsustainable harvesting of natural resources, overfishing, and hunting can lead to the decline or extinction of species, disrupt food webs, and destabilize ecosystems.
4. Climate Change: Global climate change, primarily driven by human activities, can alter temperature and precipitation patterns, causing shifts in ecosystem composition and distribution.
5. Invasive Species: The introduction of non-native species into ecosystems can outcompete native species, disrupt ecological interactions, and lead to the decline of native biodiversity.

Example of a Food Chain/Food Web: A food chain represents the transfer of energy and nutrients from one organism to another in a linear fashion. Here's a simplified example:

Grass → Grasshopper → Frog → Snake → Hawk

In this food chain, grass is the producer that converts sunlight into energy through photosynthesis. The grasshopper is the primary consumer that feeds on the grass. The frog is the secondary consumer that preys on the grasshopper. The snake is the tertiary consumer that consumes

6. What are the effects of global warming? Why climate change is a major concern in Vietnam?

Global warming, which refers to the long-term increase in Earth's average surface temperature, is primarily caused by the accumulation of greenhouse gases (such as carbon dioxide) in the atmosphere due to human activities. The effects of global warming and climate change are wide-ranging and can have significant impacts on various aspects of the environment, ecosystems, and human society. Here are some of the effects of global warming:

1. Rising Temperatures: Global warming leads to higher average temperatures worldwide, resulting in heatwaves, increased frequency and intensity of wildfires, and heat-related health risks for humans and wildlife.
2. Melting Ice and Rising Sea Levels: Higher temperatures cause the melting of glaciers and ice caps, leading to the rise in sea levels.

3. Changes in Precipitation Patterns: Climate change can alter rainfall patterns, resulting in more frequent and severe droughts in some regions, while other areas may experience increased rainfall and flooding.
4. Impact on Ecosystems: Climate change affects ecosystems and biodiversity by disrupting natural habitats, altering migration patterns, and increasing the risk of extinction for many plant and animal species.
5. Ocean Acidification: Increased carbon dioxide levels in the atmosphere lead to the absorption of more CO2 by the oceans, causing ocean acidification. .
6. Extreme Weather Events: Global warming contributes to more frequent and intense extreme weather events, including hurricanes, cyclones, storms, and heavy rainfall events..

Vietnam, in particular, is highly vulnerable to climate change due to its geographical location, extensive coastline, and dependence on agriculture and natural resources. Here are some reasons why climate change is a major concern in Vietnam:

1. Sea Level Rise and Coastal Erosion: Vietnam has a long coastline, with many densely populated coastal areas.
2. Increased Flooding and Extreme Weather Events: Vietnam experiences regular flooding due to its complex river systems and monsoon climate.
3. Agricultural Impacts: Agriculture is a vital sector in Vietnam's economy, employing a significant portion of the population.
4. Loss of Biodiversity and Ecosystem Services: Vietnam is home to diverse ecosystems, including forests, wetlands, and coral reefs, which provide essential services such as water filtration, carbon sequestration, and habitat for numerous species.
5. Human Health Risks: Climate change can affect public health in various ways. Rising temperatures can lead to heat-related illnesses, while changes in rainfall patterns can impact water quality and increase the risk of waterborne diseases.

Recognizing the vulnerability and risks posed by climate change, Vietnam has been actively implementing adaptation and mitigation strategies to address the impacts. These include measures such as developing climate-resilient infrastructure

7. Forms of Energy: Definitions, Classification, Concept of each kind of energy, and examples

Energy is the ability to do work or cause a change. There are various forms of energy, each with its own definition, classification, and concept. Here are some common forms of energy:

1. Kinetic Energy: Kinetic energy is the energy possessed by an object due to its motion. The amount of kinetic energy depends on the mass and velocity of the object.
2. Potential Energy: Potential energy is the energy stored in an object based on its position or configuration. There are different types of potential energy:
    - Gravitational Potential Energy: It is the energy an object possesses due to its height above the ground.
    - Elastic Potential Energy: It is the energy stored in a stretched or compressed object.

- Chemical Potential Energy: It is the energy stored in the bonds between atoms and molecules.

3. Thermal Energy: Thermal energy is the energy associated with the temperature of an object or a substance.
4. Electrical Energy: Electrical energy is the energy associated with the flow of electric charges. It powers electrical devices and systems.
5. Light Energy: Light energy, or radiant energy, refers to the energy carried by electromagnetic waves. It includes visible light, ultraviolet light, and other forms of electromagnetic radiation.
6. Sound Energy: Sound energy is the energy produced by vibrations that travel as sound waves through a medium, such as air, water, or solids. It is what we perceive as sound.
7. Nuclear Energy: Nuclear energy is the energy released from the nucleus of an atom through processes like nuclear fission or fusion.
8. Chemical Energy: Chemical energy is the energy stored in the bonds between atoms in molecules. It is released or absorbed during chemical reactions.

These forms of energy can often be converted from one form to another, according to the law of conservation of energy. This allows for the interconversion and utilization of energy in various processes and systems.

8. Calculate the GHGs emission in 1 crop if we use 10L diesels, 10kg Nitrogen fertilizer, and 5000kWh electricity; assume these materials release CO2, N2O, and CH4. Please using GWP CO2 equivalence factor to convert it into CO2 emission (refer the below table)

Global Warming Potential

Gaseous emissions (g) per unit of chemical sources and their global warming potential

Inputs	**CO_2**	**N_2O**	**CH_4**
1. Diesel (L)	3875.70	0.14	0.65
2. Nitrogen fertilizer (kg)	10,125.56	0.17	0.24
3. Phosphate (P_2O_5) (kg)	1496.49	0.02	0.02
4. Potassium (K_2O) (kg)	973.20	0.03	0.04
5. Electricity (kW h)	948.48	0.01	0.01
GWP CO_2 equivalence factor	1.00	265.00	28.00

Yang et al. (2014). J Clean Prod 76:131–139 27

Input	CO2	N2O	CH4
10l Diesels	3875.7 * 10 = 38357(g)	0.14*10=1.4g	0.65*10=6.5g

10kg nitrogen fertilizer	10135.56*10 = 101355.6g	0.17*10= 1.7g	0.24*10=2.4g
5000kW eclectricity	948.48*5000= 4,742,400g	0.01*5000=50g	0.01*5000=50g
Total	4,882,412.6g	53.1g	58.9g
GWP CO2 equivalence factor	4,882,412.6 * 1 = 4,882,412.6g	53.1*265 = 14071.5 g	58.9*28=1649.2g
Total GWP CO2 equivalence factor	4898133.3 g = 4898kg		

9. The role of each Environmental Protection tool? List and describe economic instruments: taxation, charge, and fees; give examples for each.

Environmental protection tools are used to promote sustainable practices, mitigate environmental degradation, and encourage the conservation of natural resources. These tools can be classified into regulatory approaches and economic instruments. Economic instruments aim to internalize environmental costs into economic decision-making by altering the price signals associated with environmental goods and services. Here are the three main types of economic instruments and examples for each:

1. Taxation: Taxation involves levying taxes on activities that generate negative environmental impacts. The goal is to discourage such activities by increasing their cost. Some examples of environmental taxes include:
    - Carbon Tax: A tax imposed on the emission of carbon dioxide and other greenhouse gases.
    - Fuel Tax: A tax on the consumption of fossil fuels, such as gasoline or diesel.
    - Waste Disposal Tax: A tax imposed on the disposal of waste in landfills. It encourages waste reduction, recycling, and the adoption of more sustainable waste management practices.
2. Charges and Fees: Charges and fees involve setting a price for the use or consumption of environmental resources or services. They aim to reflect the true cost of resource use and encourage responsible behavior. Some examples include:

- Water Use Charges: Charges imposed on industrial or agricultural users based on the volume of water they consume.
- Congestion Charges: Charges levied on vehicles entering congested areas or during peak traffic hours.
- Pollution Fees: Fees imposed on polluting activities, such as emissions or effluent discharges.

3. Tradable Permits/Cap and Trade: Tradable permits, also known as cap and trade systems, create a market for the trading of permits that allow a certain level of pollutant emissions. The total number of permits is limited (capped) to achieve overall emissions reduction. Some examples include:

- Carbon Emission Trading: A system where companies are allocated a certain number of permits to emit a specific amount of carbon dioxide. .
- Water Pollution Trading: A system that allows the trading of permits for the discharge of pollutants into water bodies.

These economic instruments provide economic incentives for individuals, businesses, and industries to adopt environmentally friendly practices, reduce pollution, and conserve natural resources. They can be effective in achieving environmental goals while promoting economic efficiency and innovation.

10. The wastewater treatment diagram? Describe each stage in the wastewater treatment plant.

A wastewater treatment plant (WWTP) follows a series of stages to effectively treat and purify wastewater before it is released back into the environment. Here is a general overview of the stages involved in a typical wastewater treatment process:

1. Preliminary Treatment: The wastewater treatment process begins with preliminary treatment, which involves the removal of large debris and solids.
2. Primary Treatment: In the primary treatment stage, the wastewater flows into large settling tanks called primary clarifiers. Here, the heavier solids and organic matter settle to the bottom as sludge, while lighter materials float to the surface as scum.
3. Secondary Treatment: Secondary treatment focuses on the biological breakdown of organic matter and the removal of dissolved and colloidal substances. The primary effluent enters aeration tanks, where it is mixed with air and populated with microorganisms.

After the aeration process, the wastewater flows into secondary clarifiers, where the activated sludge settles to the bottom. Some of the settled sludge is returned to the aeration tanks to maintain an adequate population of microorganisms, while excess sludge is removed for further treatment.

1. Tertiary Treatment: Tertiary treatment, also known as advanced treatment, is an optional stage that aims to further remove any remaining pollutants from the wastewater.
    - Filtration: The wastewater passes through filters, such as sand or activated carbon filters, to remove fine particles and residual impurities.
    - Disinfection: Chemical disinfectants (e.g., chlorine) or physical methods (e.g., ultraviolet light) are used to kill or inactivate disease-causing microorganisms present in the wastewater.
    - Nutrient Removal: Processes like biological nutrient removal (BNR) can be employed to reduce the levels of nutrients like nitrogen and phosphorus, which can contribute to water pollution.
2. Sludge Treatment: The sludge collected during primary and secondary treatment stages undergoes further treatment. This includes processes such as thickening, digestion, and dewatering to reduce its volume, stabilize it, and convert it into a more manageable and less odorous form.
3. Discharge or Reuse: Once the wastewater has gone through the treatment processes and meets the required standards, it is discharged into receiving water bodies (e.g., rivers, lakes, or oceans) or reused for non-potable purposes like irrigation, industrial processes, or groundwater recharge, depending on local regulations and the quality of treated water.

It's important to note that the specific design and processes involved in a wastewater treatment plant may vary based on the size of the facility, the level of treatment required, and the specific regulations of the region or country.

11. List and describe 17 Sustainable Development Goals

the 17 SDGs along with brief descriptions:

1. No Poverty: End poverty in all its forms and dimensions, ensuring social protection, and providing equal access to resources and opportunities for all.
2. Zero Hunger: Achieve food security, improve nutrition, and promote sustainable agriculture to eliminate hunger and malnutrition worldwide.
3. Good Health and Well-being: Ensure healthy lives and promote well-being for people of all ages, focusing on reducing child and maternal mortality, combating diseases, and providing universal access to healthcare services.
4. Quality Education: Ensure inclusive and equitable quality education for all, promoting lifelong learning opportunities and skills development.
5. Gender Equality: Achieve gender equality and empower all women and girls by ending discrimination, violence, and harmful practices, and ensuring equal access to opportunities in all spheres of life.
6. Clean Water and Sanitation: Ensure access to clean water and adequate sanitation for all, improving water quality, and promoting sustainable water use.
7. Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable, and modern energy for all, while transitioning to clean energy sources and increasing energy efficiency.
8. Decent Work and Economic Growth: Promote inclusive and sustainable economic growth, full and productive employment, and decent work for all, while ensuring fair and safe working conditions.
9. Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote sustainable industrialization, and foster innovation to support sustainable development and economic growth.
10. Reduced Inequalities: Reduce inequalities within and among countries, addressing disparities in income, social protection, and opportunities based on factors such as age, gender, disability, race, and ethnicity.
11. Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable, focusing on affordable housing, sustainable transport, and access to basic services.
12. Responsible Consumption and Production: Promote sustainable consumption and production patterns, ensuring sustainable resource use, waste reduction, and environmentally friendly practices.
13. Climate Action: Take urgent action to combat climate change and its impacts, including raising awareness, mitigating greenhouse gas emissions, and building resilience to climate-related risks.
14. Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources, promoting marine conservation, reducing pollution, and addressing overfishing.

15. Life on Land: Protect, restore, and sustainably manage terrestrial ecosystems, promoting sustainable land use, combating deforestation, and halting biodiversity loss.
16. Peace, Justice, and Strong Institutions: Promote peaceful and inclusive societies, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
17. Partnerships for the Goals: Strengthen the means of implementation and revitalize global partnerships for sustainable development, fostering collaboration among governments, private sector, civil society, and other stakeholders.

These goals are interconnected and address the complex challenges facing our planet, aiming to create a more sustainable, equitable, and prosperous future for all. Achieving the SDGs requires collective action and cooperation at local, national, and global levels.

12. Give an example of using Barometer of Sustainability to compare the Human Welling and Ecosystem Welling between two provinces A and

To compare the Human Wellbeing and Ecosystem Wellbeing between two provinces, A and B, using a Barometer of Sustainability, you would need to assess various indicators under each dimension. Here's an example of how you could approach this comparison:

1. Human Wellbeing:
- Economic Indicators: Compare the GDP per capita, income levels, employment rates, and poverty rates between the two provinces.
- Social Indicators: Evaluate indicators such as education levels, healthcare access, life expectancy, crime rates, and social inequality (e.g., Gini coefficient).
- Quality of Life Indicators: Consider factors like access to clean water, sanitation facilities, housing conditions, access to basic services (e.g., electricity, transportation), and cultural heritage preservation.
2. Ecosystem Wellbeing:
- Biodiversity: Assess the richness and diversity of species, habitat fragmentation, presence of protected areas, and conservation efforts.
- Land Use and Conservation: Evaluate land use practices, deforestation rates, conservation measures, and the extent of degraded land.
- Water Resources: Analyze water quality, availability, and usage patterns, as well as the implementation of water management and conservation strategies.
- Air Quality: Compare air pollution levels, emissions from industries, transportation, and energy generation, and the presence of air quality monitoring systems.
- Climate Change Resilience: Consider measures to mitigate and adapt to climate change, renewable energy usage, greenhouse gas emissions, and vulnerability to climate-related events.

By assessing and comparing these indicators, you can create a Barometer of Sustainability that highlights the strengths and weaknesses of each province in terms of Human Wellbeing and Ecosystem Wellbeing. This analysis can help identify areas for improvement, prioritize interventions, and guide policy and decision-making processes towards sustainable development.