

# Assessment Handout: Environmental Science and Sustainability

## Introduction

Welcome to this assessment on Environmental Science and Sustainability! This handout is designed to evaluate your understanding of the circular economy, bioeconomy, and your ability to design sustainable products, analyze socio-economic impacts, and develop critical thinking and problem-solving skills. The concept of sustainability is crucial in today's world, and it is essential to understand the principles and practices that can help us achieve a more sustainable future.

The circular economy is an economic system that aims to reduce waste and promote recycling and reuse of resources. It is based on the concept of "reduce, reuse, recycle" and seeks to minimize the environmental impacts of human activities. On the other hand, the bioeconomy is an economic system that uses renewable biological resources to produce goods and services. It is a key component of the circular economy and has the potential to reduce our reliance on non-renewable resources.

## Section 1: Multiple Choice Questions (20 minutes)

Question 1 [3 marks]

What is the primary goal of a circular economy?

- A) To reduce waste and promote recycling
- B) To increase consumption and economic growth
- C) To conserve natural resources and reduce pollution
- D) To promote sustainable development and social equity

Question 2 [3 marks]

Which of the following is an example of a bioeconomic product?

- A) Plastic bag
- B) Biodegradable packaging
- C) Fossil fuel
- D) Electronic device

Question 3 [3 marks]

What is the main difference between a linear economy and a circular economy?

- A) Linear economy focuses on recycling, while circular economy focuses on reducing waste
- B) Linear economy focuses on reducing waste, while circular economy focuses on recycling
- C) Linear economy is based on the concept of "take, make, dispose", while circular economy is based on the concept of "reduce, reuse, recycle"
- D) Linear economy is more sustainable than circular economy

## Section 2: Short Answer Questions (30 minutes)

Question 4 [10 marks]

Compare and contrast the durability of old and modern school materials. Provide examples of each.

Question 5 [15 marks]

Describe the concept of a circular economy and its benefits for the environment and society.

Question 6 [10 marks]

What are some of the advantages and disadvantages of using biodegradable materials in product design?

### Section 3: Case Study (40 minutes)

Question 7 [10 marks]

A local community is planning to develop a new sustainable product for 2050. The product should be designed to reduce waste, promote recycling, and conserve natural resources. The community has identified two potential products: a biodegradable water bottle and a reusable shopping bag. Evaluate the socio-economic impacts of each product and recommend which one to develop.

a) What are the potential environmental benefits of each product? [5 marks]

b) What are the potential socio-economic benefits of each product? [3 marks]

c) Which product do you recommend and why? [2 marks]

## Section 4: Design Challenge (30 minutes)

Question 8 [20 marks]

Design a sustainable product for 2050 that addresses the following criteria:

- Reduces waste and promotes recycling
- Conserves natural resources
- Promotes social equity and sustainable development

## **Marking Guide**

Section 1: Multiple Choice Questions (3 marks each)

Section 2: Short Answer Questions (10-15 marks each)

Section 3: Case Study (10-10-10 marks)

Section 4: Design Challenge (20-10-10 marks)

## Implementation Guidelines

Time allocation: 120 minutes

Administration tips:

- Ensure students have access to necessary materials and resources
- Provide clear instructions and examples for each section
- Encourage students to ask questions and seek clarification when needed
- Allow students to work individually or in groups, depending on the task

## **Differentiation Options**

For students with learning difficulties:

- Provide additional time and support for each section
- Offer visual aids and graphic organizers to assist with organization and coherence
- Allow students to complete the assessment in a separate room or with a teacher assistant

For English language learners:

- Provide bilingual resources and support
- Offer visual aids and graphic organizers to assist with comprehension
- Allow students to complete the assessment with a language support teacher

For gifted and talented students:

- Provide additional challenges and extensions for each section
- Encourage students to design and develop their own sustainable product
- Allow students to work in groups to design and develop a sustainable product



## **Bloom's Taxonomy Alignment**

Knowledge: Questions 1-3 (Section 1)

Comprehension: Questions 1-3 (Section 2)

Application: Case study (Section 3)

Analysis: Design challenge (Section 4)

Synthesis: Design challenge (Section 4)

Evaluation: Case study (Section 3) and design challenge (Section 4)

## **Multiple Intelligence Approaches**

Linguistic: Questions 1-3 (Sections 1-2)

Logical-mathematical: Case study (Section 3) and design challenge (Section 4)

Spatial: Design challenge (Section 4)

Bodily-kinesthetic: Design challenge (Section 4)

Musical: Not applicable

Interpersonal: Case study (Section 3) and design challenge (Section 4)

Intrapersonal: Case study (Section 3) and design challenge (Section 4)

Naturalistic: Case study (Section 3) and design challenge (Section 4)

## **Clear Success Criteria**

Understanding of the concept of circular economy and bioeconomy

Ability to compare and contrast the durability of old and modern school materials

Ability to design a sustainable product for 2050

Ability to analyze socio-economic impacts of linear economy

Development of critical thinking and problem-solving skills

## **Evidence Collection Methods**

Student responses to questions and tasks

Design plans and products

Case study evaluations and recommendations

Peer and self-assessment

## **Feedback Opportunities**

Immediate feedback after each section

Feedback on design plans and products

Peer feedback and self-assessment

Teacher feedback and guidance throughout the assessment process

## **Additional Resources**

Diagrams and illustrations of circular economy and bioeconomy concepts

Examples of sustainable products and designs

Case studies of successful sustainable product development

Online resources and websites for further research and learning

## **Glossary**

**Circular economy:** An economic system that aims to reduce waste and promote recycling and reuse of resources.

**Bioeconomy:** An economic system that uses renewable biological resources to produce goods and services.

**Sustainable development:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

## **References**

United Nations. (2015). Sustainable Development Goals.

Ellen MacArthur Foundation. (2019). What is a circular economy?

European Commission. (2020). Bioeconomy Strategy.



## **Advanced Concepts**

As we delve deeper into the world of environmental science and sustainability, it is essential to explore advanced concepts that can help us better understand the complexities of the natural world. One such concept is the idea of systems thinking, which involves analyzing complex systems and their interconnectedness to identify patterns, relationships, and feedback loops. This approach can help us develop a more holistic understanding of environmental issues and identify effective solutions.

### **Case Study: The Amazon Rainforest**

The Amazon rainforest is a prime example of a complex system that is facing numerous environmental challenges. Deforestation, climate change, and pollution are all taking a toll on this delicate ecosystem, with far-reaching consequences for biodiversity, indigenous communities, and the global climate. By applying systems thinking to this issue, we can begin to understand the intricate relationships between the forest, its inhabitants, and the surrounding environment, and develop more effective strategies for conservation and sustainability.

### **Example: Systems Thinking in Action**

A great example of systems thinking in action is the work of the Amazon Conservation Association (ACA), which is working to protect the Amazon rainforest through a holistic approach that takes into account the complex relationships between the forest, its inhabitants, and the surrounding environment. By engaging with local communities, supporting sustainable land-use practices, and promoting conservation efforts, the ACA is helping to preserve the Amazon's biodiversity and mitigate the effects of climate change.

## **Sustainable Development Goals**

The Sustainable Development Goals (SDGs) are a set of 17 goals adopted by the United Nations in 2015, which aim to end poverty, protect the planet, and ensure prosperity for all by 2030. The SDGs provide a framework for achieving sustainable development and can be used to guide policy and decision-making at the local, national, and international levels. By understanding the SDGs and their targets, we can better address the complex challenges facing our world and work towards a more sustainable future.

### **SDG 13: Climate Action**

SDG 13 aims to take urgent action to combat climate change and its impacts, by reducing greenhouse gas emissions, promoting sustainable land use, and supporting climate change research and development. This goal is critical to achieving a sustainable future, as climate change poses a significant threat to ecosystems, human health, and the economy.

### **SDG 14: Life Below Water**

SDG 14 aims to conserve and sustainably use the world's oceans, seas, and marine resources, by reducing marine pollution, protecting marine ecosystems, and promoting sustainable fishing and aquaculture practices. This goal is essential to maintaining the health of our planet, as the oceans play a critical role in regulating the climate, providing food and livelihoods, and supporting biodiversity.

## **Environmental Policy and Law**

Environmental policy and law play a critical role in protecting the natural world and promoting sustainable development. By understanding the key principles and concepts of environmental policy and law, we can better navigate the complex regulatory landscape and work towards a more sustainable future. This includes understanding the role of international agreements, national laws, and local regulations in protecting the environment, as well as the importance of public participation, access to information, and access to justice in environmental decision-making.

## **The Paris Agreement**

The Paris Agreement is an international agreement that aims to limit global warming to well below 2°C and pursue efforts to limit it to 1.5°C above pre-industrial levels. The agreement provides a framework for countries to reduce greenhouse gas emissions, adapt to the impacts of climate change, and support climate change research and development. By understanding the principles and provisions of the Paris Agreement, we can better address the global challenge of climate change and work towards a more sustainable future.

## **The Endangered Species Act**

The Endangered Species Act (ESA) is a national law that aims to conserve and recover threatened and endangered species in the United States. The ESA provides a framework for listing species, designing recovery plans, and implementing conservation measures to protect species and their habitats. By understanding the principles and provisions of the ESA, we can better protect biodiversity and promote ecosystem health.

## **Sustainable Business and Economics**

Sustainable business and economics involve the application of sustainable principles to business and economic decision-making, with the aim of reducing environmental impacts, promoting social equity, and ensuring economic viability. By understanding the key concepts and principles of sustainable business and economics, we can better navigate the complex relationships between business, the environment, and society, and work towards a more sustainable future.

### **Triple Bottom Line**

The triple bottom line (TBL) is a framework for measuring the sustainability of a business or organization, by considering its economic, social, and environmental impacts. The TBL provides a holistic approach to business decision-making, by taking into account the complex relationships between business, the environment, and society. By applying the TBL, businesses can better manage their sustainability performance and contribute to a more sustainable future.

### **Circular Economy Business Models**

Circular economy business models involve the design of products and services that are restorative and regenerative by design, by promoting the reuse and recycling of materials, reducing waste, and minimizing environmental impacts. By applying circular economy principles to business decision-making, companies can reduce their environmental footprint, promote sustainable consumption, and contribute to a more sustainable future.

## **Community Engagement and Participation**

Community engagement and participation are critical to achieving sustainable development and promoting environmental protection. By engaging with local communities, listening to their concerns, and involving them in decision-making processes, we can better understand the complex relationships between human and natural systems and work towards a more sustainable future. This includes understanding the importance of public participation, access to information, and access to justice in environmental decision-making, as well as the role of community-based initiatives and grassroots movements in promoting sustainability.

## **Community-Based Initiatives**

Community-based initiatives involve the development of projects and programs that are designed and implemented by local communities, with the aim of promoting sustainability and environmental protection. By supporting community-based initiatives, we can empower local communities to take action on environmental issues, promote sustainable development, and contribute to a more sustainable future.

## **Grassroots Movements**

Grassroots movements involve the mobilization of individuals and communities to promote social and environmental change, by raising awareness, building capacity, and advocating for policy and legislative reforms. By supporting grassroots movements, we can promote sustainability, environmental protection, and social justice, and contribute to a more sustainable future.

## **Education for Sustainability**

Education for sustainability involves the development of knowledge, skills, and values that are necessary to promote sustainable development and environmental protection. By understanding the key principles and concepts of education for sustainability, we can better navigate the complex relationships between education, the environment, and society, and work towards a more sustainable future. This includes understanding the importance of interdisciplinary approaches, experiential learning, and community engagement in promoting sustainability education.

## **Interdisciplinary Approaches**

Interdisciplinary approaches to sustainability education involve the integration of multiple disciplines and perspectives, with the aim of promoting a holistic understanding of sustainability and environmental issues. By applying interdisciplinary approaches to sustainability education, we can better prepare students to address the complex challenges of the 21st century and contribute to a more sustainable future.

## **Experiential Learning**

Experiential learning involves the use of hands-on, real-world experiences to promote learning and skill-building, with the aim of preparing students to address the complex challenges of the 21st century. By applying experiential learning approaches to sustainability education, we can better prepare students to promote sustainability and environmental protection, and contribute to a more sustainable future.

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