**(AP) ENVIRONMENTAL SCIENCE 2022-23 January 23, 2023**

**Today’s Agenda (Day 93)**

1. Housekeeping Items

🡪 BRING:

1. Homework Check:

🡪 Chapter 11 Reading Guide

🡪 Lab: Strip Mining

🡪 Lab: Cookie Mining

1. Class Activity:

🡪 Day 15: Science Fair

\*Finalize Experimental Setup – Gather all materials, prepare all supporting apparatus

\*Begin Day 1 of your experiment – AFTER approval by teacher!

🡪

🡪DAY 1: Chapter 11 PPT Review

1. **Section 11.1 – Biodiversity Loss and Extinction**
2. Section 11.2 – The Value of Biodiversity
3. Section 11.3 – Threats to Biodiversity
4. Section 11.4 – What is Being Done to Preserve Biodiversity

HOMEWORK:

* READ: Chapter 11 – Biodiversity Issues
* COMPLETE: ~~Chapter 11 Reading Guide Questions~~
* **STUDY**: Chapter 11 Vocabulary Quiz and Test

Chapter 11 Vocabulary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Aquaculture | Bioprospecting | Biodiversity | Bush meat | Clear-cutting | Convention on Biological Diversity |
| Convention on International Trade in Endangered Species (CITES) | Cover | Deforestation | Desertification | Ecosystem diversity | Endangered species |
| Endangered Species Act (ESA) | Endemism | Extinction | Genetic diversity | Habitat loss | Habitat management |
| International Union for Conservation of Nature and Natural Resources (IUCN) | Migratory birds | Overexploitation | Patchwork clear-cutting | Rangeland | Reforestation |
| Selective breeding | Species diversity | Threatened species |  |  |  |

REMINDER

* **QUIZ: Ch 11 Vocabulary 🡪 Jan. 24**
* **TEST: Ch 11🡪 Thursday, Jan. 26**

Chapter 12 Vocabulary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Brownfields | Brownfields development | Floodplain zoning ordinances | Floodplains | Infrastructure | Land-use planning |
| Megacity | Megalopolis | Ribbon sprawl | Tract development | Urban growth limit | Urban sprawl |
| Wetlands | zoning |  |  |  |  |

Chapter 13 Vocabulary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Asthenosphere | Chemical weathering | Conservation tillage | Contour farming | Crust | Erosion |
| Friable | Horizon | Humus | Hyperaccumulators | Land | Leaching lithosphere |
| Litter loam | Mantle | Mechanical weathering | Parent material | Phytoremediation | Plate tectonics |
| Reduced tillage | Soil | Soil profile | Soil texture | Strip farming | Terraces |
| Waterways | Weathering | windbreaks |  |  |  |

**(AP) ENVIRONMENTAL SCIENCE 2022-23 LAB ACTIVITY**

**LAB: Strip Mining**

Objective: Students will understand the concept of strip mining and how difficult it is to “reclaim” land once it has been mined. Students will also understand basic mining vocabulary and policies related to mining and environmental damage.

Materials:

• cupcake w/ cream center aka ‘Ding Dong’ • plastic knife • straw (clear)

• ruler • scissors

Procedure:

1. Initial Research – Create Mine Schematic

* Measure cupcake height and diameter in centimeters.
* Draw a scale diagram of your cupcake (land).
* Create a scale legend for your drawing (1cm = 100 ft).

2. Find Exact Location of Mineral - Take Core Samples

* Plunge the straw into the top of the cupcake until you reach the bottom.
* Twist the straw slightly and pull it out.
* Take at least 2 more core samples. You are trying to find the cream center, which represents your valuable ore.
* Use scissors to carefully cut open the straws.
* Use this core sample to draw a scale diagram (view from the top) of where your ore is located including measurements in cm. (add to the drawing above)

3. Remove Overburden & Extract Mineral

* In mining, the overburden is waste earth & rock covering a valuable mineral deposit. Using your knife as a representation of the tools of mining, remove the overburden & extract your mineral ore.
* Draw a scale diagram of exactly where you found your ore, and then evaluate the accuracy of the hypothesis you made using core samples.
* For example- did you correctly predict where the ore would be found based on these initial assessments? Explain.

4. Replace Overburden & Study Effects on Mine Area

* Does the area mined look the same once the mineral is extracted?
* Take height and diameter measurements in centimeters, & draw a revised diagram of your land.
* Calculate the percentage decrease in height of your mined area.
* Show calculations and explain what you found.

5. Conclusion

* In your own words, explain the procedure of this lab as well as how it relates to strip mining.
* Also, list at least 3 harmful effects of strip mining on the environment.

6. Explain The Surface Mining Control and Reclamation Act. What does this act require coal-mining companies to do? Is it successful? Why or why not?

**(AP) ENVIRONMENTAL SCIENCE 2022-23 READING GUIDECHAPTER 11**

REVIEW QUESTIONS

1. Name three ways humans directly alter ecosystems.

2. Why is the impact of humans greater today than at any time in the past?

3. Describe three factors that influence the genetic diversity of a population.

4. Describe three major causes of the loss of biodiversity.

5. What are the major causes of biodiversity loss in marine ecosystems?

6. List three problems associated with forest exploitation.

7. What is desertification? What causes it?

8. List three key components of the Convention on Biological Diversity (biodiversity treaty).

9. List six techniques utilized by wildlife managers.

10. What special problems are associated with waterfowl management?

11. What is extinction, and why does it occur?

12. List three examples of ecosystem services provided by biological resources.

13. List three actions that can be taken to prevent extinctions.

14. Describe the relationship between habitat needs of a species and the overall survival success of the species.

15. Describe the role of the Red List of Threatened Species in species conservation.

CRITICAL THINKING QUESTIONS [for APES students only]

1. Perhaps 98 percent to 99 percent of all species that have ever existed are extinct. Nearly all went extinct long before humans arrived on the scene. Why should we be concerned about the extinction of organisms today?

2. Would you support clearing of forests and plowing of grasslands that are ecologically important in order to support agriculture in countries that have significant hunger? Where do you draw the line between preserving ecosystems and human interest?

3. A Pacific Northwest Native American tribe has been permitted to hunt an endangered whale species to preserve its traditional culture and uphold its treaty rights. Now there is fear that other countries will hunt the whales, too. Do you think the tribe should be denied its rights? Why or why not?

4. Pharmaceutical companies are helping some developing countries to preserve their rainforests so these companies can look for organisms with possible pharmacological value. How do you feel about these arrangements? What limits, if any, would you place on the pharmaceutical companies? Why?

**(AP) ENVIRONMENTAL SCIENCE 2022-23 READING GUIDECHAPTER 12**

REVIEW QUESTIONS

1. List three reasons why land-use planning is necessary.

2. Why did urban centers develop near waterways?

3. List three factors that encouraged people to move from rural farms to cities in the 1800s.

4. List three factors that encouraged people to leave the cities for suburbs.

5. List three physical and three social consequences of suburban sprawl.

6. Describe tract development, ribbon sprawl, and leapfrog development.

7. What is a megalopolis?

8. Describe how each of the following factors contributed to the development of suburban sprawl: automobiles, home ownership, tax laws, local zoning ordinances, federal government policies.

9. State three consequences of the dominance of the automobile as a means of transport in urban areas.

10. What characteristics of suburbs contribute to a loss of sense of community?

11. What characteristics of suburbs contribute to high infrastructure and high energy costs?

12. How does the development of suburbs around a city contribute to loss of open space, and air and water pollution problems?

13. What land uses are suitable on floodplains?

14. Describe three values provided by wetlands.

15. Why is an understanding of the geology and resource base of an area important in land-use planning?

16. List eight principles that should be involved in good land-use planning.

17. What role do state and regional planning, purchasing of land, and use restrictions play in implementing land-use plans?

18. Describe three common land-use issues cities must deal with.

19. List ten common smart growth principles.

20. List four major federal agencies that manage federal lands and their primary responsibilities.

21. Give examples of conflict over the use of federally owned property.

CRITICAL THINKING QUESTIONS [for APES students only]

1. Choose the city where you live. Interview local residents and look at old city maps. What did the city look like 75 years ago? What were the city’s boundaries? Where did people do their shopping? How did they get around? How does this compare with the current situation in the city?

2. What historical factors brought members of your family to the city? How does this compare to the factors that are currently contributing to the growth of cities in the developing world?

3. Consider the outer rim of the city closest to you. Which, if any, of the problems associated with unplanned growth are associated with your city? What factors make them a problem? What do you think can be done about them?

4. There has been tremendous development in the arid West of the United States over the past few decades, creating demands for water. How should these demands be met? Should there be limits to this type of development? What kinds of limits, if any?

5. Imagine you are a U.S. Forest Service supervisor who is creating a ten-year plan that is in the public comment stage. What interests would be contacting you? What power would each interest have? How would you manage the competing interests of timber, mining, grazing, and recreation or those between motorized and nonmotorized recreation? What values, beliefs, and perspectives help you to form your recommendations?

6. Imagine that you lived in an area of the country that has the potential to be named a wilderness area. What conflicts do you think would arise from such a declaration? Who might be some of the antagonists? Which perspective do you think is most persuasive? How would you answer the objections of the other perspective?

**(AP) ENVIRONMENTAL SCIENCE 2022 -23 Lab Activity**

**LAB: Cookie Mining Activity**

A picture containing sky, outdoor, truck, ground

Description automatically generated**Background Information:**

Fossil fuels *(natural gas, oil and coal)* are created by the decomposition of dead plants and animals over millions of years and with a little help from high temperatures and high pressures.

The fuels contain stored potential energy that originally came from the Sun. Fossil fuel extraction *(harvesting of coal, oil and natural gas)* can be very damaging to ecosystems. Coal mining can strip the surface of the Earth, leaving desolate areas permanently damaged. Petroleum extraction or transportation can spill and kill wildlife or soak through the aquifer to contaminate our water supply. Our government creates laws to protect the environment and levies fines to companies that damage the environment due to accidents or damaging extraction methods. **Ninety percent** of the energy we use in the United States comes from fossil fuels. The U.S. uses more than ***17 million barrels of oil everyday account for over 40% of our country’s energy.***  Stored chemical energy in coal is converted into the thermal energy of steam when the coal is burned. This thermal energy, in turn, is converted to mechanical energy that spins turbines to create electricity. Coal is used to produce almost ***60% of our nation’s electrical power and accounts for 22% of our overall energy consumption.***  The third form of fossil fuel, ***natural gas, accounts for almost 23% of our usage.***  Each American uses an average of 7 gallons of gasoline every day. **The United States only has 5% of the world’s population but consumes 26% of the world’s energy.**

**Purpose:** *The purpose of this activity is to simulate a mining operation. In order to simulate a real mining operation:*

* *A land area will be purchased from the bank*
* *The land area will be surveyed and quantified*
* *Mining equipment will be purchased from the bank*
* *A mining operation will be undertaken, with the cost for each minute of the mining operation included in the total operating costs*
* *At the conclusion of mining operations, the reclamation of the land area is required, with a fine assessed for any part of the land that is not successfully reclaimed*
* *The ore that was mined will be sold back to the bank to offset the start-up costs of the mining operation*

**Procedure:**

1: Each miner must obtain a sheet of graph paper and purchase a land area (cookie), on credit, for the bank.

* **Mother’s Cookie- $3.00**
* **Chips Ahoy- $5.00**
* **Chips Deluxe- $7.00**

2: Each miner may purchase any combination of the following mining equipment, on credit, from the bank *(at least two items MUST be purchased)*

* **Flat Toothpick- $50,000**
* **Round Toothpick- $75,000**
* **Plastic Fork/Pick- $100,000**
* **Paper Clip- $100,000**

3: Following the purchase of the land and mining equipment, place the land on the graph paper, trace the outline of the cookie, determine the area of the cookie by counting the number of squares that fall inside the line *(count partial squares as full squares)*, and record the area of the cookie *(size of deposit).*

4: Once mining begins, the cookie is **ONLY TO BE TOUCHED BY MINING TOOLS.** The cookie **MAY NOT** be touched with fingers or hands. You MAY NOT blow crumbs off the paper at any time. Any part of the cookie that falls off the graph paper is considered “lost” and should not be retrieved until the simulation is complete.

5: Attempt to dig out as many chocolate chips as possible. The chocolate chips represent ORE and will be sold to the bank to offset the start-up costs of the mining operation.

Whole, clean, intact chocolate chips ONLY will be purchased for full price. 1/2 chips will only receive 1/2 price. The rest will be considered to be “overburden” and need to be disposed of appropriately.

6: The cost of the mining operation is **$10,000 per minute** and the **processing fee per chocolate chip is $1,500.**

7: After the cookie has been mined, reclamation must be attempted. Try to place all that remains of the cookie back into the circled area on the graph paper using the mining tools (remember, NO FINGERS or HANDS allowed!) Draw additional circles around each crumb that is not placed back in the circle and count the number of squares that fall inside all circles. The fine for **unsuccessful reclamation is $1,200 per square.**

8: When all mining and reclamation is complete and you are ready to sell your chocolate chips to the bank, arrange them in such a way that they may be easily counted, record the end time of the simulation, and raise your hand.

9: Answer the questions and summary while you are waiting for the bank to count up your ORE.

**Data Table (Resources)**

|  |  |  |
| --- | --- | --- |
|  | **Cookie #1** | **Cookie #2** |
| Cookie Area (#squares) |  |  |
| Mass-Unmined (g) |  |  |
| Mass of Ore (g) |  |  |
| Mass Difference (g) |  |  |

**Data Table (Mining Costs)**

|  |  |  |
| --- | --- | --- |
|  | **Fees $ (Cookie #1)** | **Fees (Cookie #2)** |
| Cookie Brand/Cost $ |  |  |
| Tool Rental Fees $ *(pick at least 2)* |  |  |
| Mining Costs *($10,000 per minute)* |  |  |
| Processing Fee *($1500 per chip)* |  |  |
| Labor Costs/Insurance | $2500 | $2500 |
| Reclamation Costs *($1200 per square)* |  |  |
| Overburden $1000 | $1000 | $1000 |
| **Total Mining Fees** |  |  |

**Data Table: Selling the Ore**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Cookie #1** | | **Cookie #2** | |
| Whole Chips $10,000 each |  | |  | |
| 1/2 Chips $2500 each |  | |  | |
| Total $ Made |  | |  | |
|  | | **Cookie #1** | | **Cookie #2** | |
| Total Mining Fees | |  | |  | |
| Total $ Made | |  | |  | |
| Difference ($) (-/+) | |  | |  | |

***Questions/Analysis:***

1: Were the minerals evenly distributed throughout the cookie mines? *Explain how this relates to real mining.*

2: Were you able to “reclaim” the land after mining? **Discuss issues.**

3: Do you think the animals and plants in the area are affected by strip mining? How?

4: Can you think of anything humans can do to minimize the destruction of the environment when extracting fossil fuels? Explain.

5: Explain how the time required for mining is affected by the advanced knowledge that the land must be restored.

6: Explain why legislation that requires land to be restored after mining makes mining more expensive.

7: *Look up and outline* the **Surface Mining Control and Reclamation Act**:

8: Identify when and *discuss why* the Surface Mining Control and Reclamation Act was written.

9: Speculate about the citizens and organizations most likely to **support and oppose** the Surface Mining Control and Reclamation Act.

10: What was the purpose of this activity? What was learned?