**(AP) ENVIRONMENTAL SCIENCE 2022-23 January 13, 2023**

**Today’s Agenda (Day 87)**

1. Housekeeping Items

🡪 BRING:

1. Homework Check:

🡪 SCIENCE FAIR: Literature Review and Reverence Page; Experimental Design

🡪 Chapter 10 Vocabulary

🡪 Chapter 10 Reading Guide

1. Class Activity:

🡪 Day 8: Science Fair

\*Finalize Experimental Design – identify variables (controls, independent, dependent), outline materials needed and procedures (step-by-step); OR Sketch of Prototype Design --include materials needed and timeline of how prototype will be constructed

\*Prepare to have materials ready to begin experimental study/prototype construction for MONDAY!

\*Discuss SF with teacher – finalize details for start of experiment

🡪 **CONT’D: a) Lab – Non-Renewable Energy: Natural Gas – Day 9 Observations**

  **b) Lab: Strip Mining**

 **c) Lab: Cookie Mining**

🡪MONDAY: Chapter 10 PPT Review

1. Section 9.10.2 – Major kinds of renewable energy
2. Section 10.3 – Energy Conservation

HOMEWORK:

* READ: Chapter 10 – Renewable Energy Sources
* COMPLETE:
* **STUDY**: Chapter 10 Test

Chapter 10 Vocabulary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Active solar system | Anaerobic Bioreactor | Anaerobic digestion | Biofuels | Biomass | Clerestory |
| Crop residues | Daylighting | Desertification | Fuelwood | Gasification | Geothermal energy |
| Methane Digester | Passive solar system | Photovoltaics | Pyrolysis | Renewable energy | Solar power tower |
| Sunspace | Tidal Power | Trombe wall |  |  |  |

REMINDER

* **TEST: Ch 10🡪 ~~Thursday, Jan. 12~~ Jan. 17**

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 |  |  |  |

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** **Non-Renewable Energy: How is Natural Gas Formed Laboratory Activity**

Think about the energy you use every day to cook, heat or cool or light your home, or to travel from one place to another. For most of us, the main sources of this energy are the **fossil fuels: *coal, oil, and natural gas.*** Whether used directly, as gasoline, heating oil, or natural gas, or to generate electricity (by burning coal), fossil fuels are a large part of the world’s energy picture.

**But how do fossil fuels form?**

The story starts millions of years ago, during the **Carboniferous Period of the Paleozoic Era.** The Earth was warm and was covered with plant-filled swamps and shallow seas teeming with **algae** and **simple animal life forms such as plankton.** When the plants and animals died, their remains fell to the bottom of the swamps and seas and accumulated there. Much of the organic matter decayed before it was buried by more sediment. Some of it, however, was buried before it could decay. Over millions of years, more and more **sediments accumulated and the great heat and pressure changed the plant and animal materials into coal, oil, and natural gas.** These deposits can be trapped between layers of porous and nonporous rock.

**Natural gas** is found in nearly all petroleum deposits. Coal forms in a similar manner. All three types of fossil fuel are nonrenewable resources because they are used more quickly than they can be replaced.

**Objective**

In this activity, you will make a **model** of how **natural gas might be formed** from decaying organic material.

**Materials:**

Two 1-L (1-qt) plastic bags (resealable)

Leafy green vegetables, such as lettuce, cabbage, or spinach, at room temperature

Large clear measuring cup, measuring tape

Refrigerator

Notebook, pen or marker, tape, camera

**Procedures:**

1: Take out your leafy green vegetables. If the greens are cooler or warmer than the room, leave them on a table or shelf long enough for them to come to the temperature of the room.

2: Add the greens to the measuring cup and pack them down as much as possible. Keep adding greens and pushing them down until the level of the greens is at the 250-mL (8-oz, or 1-cup) mark.

3: Fill one of the plastic bags with the greens from the measuring

cup, and then repeat the process for the second bag. You should have two bags that each contain 1 cupful of greens.

4: Distribute the greens evenly along the bottom of each bag. Then roll up each bag from the bottom—to press all of the air out—and seal tightly. If the bag is not resealable, use tape to seal the bag.

5: Once each bag is rolled up, use the measuring tape to find the circumference of the two rolled-up bags. Record this information in your notebook. **Write a description of your greens—how they look and feel— or take a photograph of each rolled-up bag.**

6: Unroll the bags and **put one in a refrigerator.** This will be the "control" bag, where the lower temperature will keep the greens from decaying quickly. Place the other bag on a table or shelf where it can remain at room temperature. *The warmer temperature will cause the greens to decay more quickly.* Be sure the bag is not in sunlight, because this will affect the experiment.

**Data Table:**



7: Once a day for next ten days, gently roll each bag and **measure the circumference.**

**Record this information in your data table.** Also, look at the greens and ***write down your observations of their appearance.*** You might also find it useful to take a picture of the bags each day.

8: On the tenth day of the experiment, measure a final distance around the two rolled bags. Record these two final measurements in your data table. *Describe how have these measurements changed over the ten days.*

9: After you have made your final measurements, **discard both bags.**

**Data Analysis**

**Discuss:** What changes do you see in the warm bag and the cool bag? How can you explain what you see? How do these changes relate to what you know about how decaying material produces natural gas?

**Conclusion:** Discuss the principles that you learned by doing this activity. What worked? What didn’t? How may you change this lab in the future? How can you expand this experiment?

**(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 Lab Activity**

**LAB: Cookie Mining Activity**

**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?

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

 LAB: Yeast Fermentation

Use the following lab to compare fermentation of various ingredients.

Choose two of the sugars as your independent variables. Compare with your control of NO sugar.

 Corn syrup

 Molasses

 Honey

 Condensed Milk

 Splenda

**HYPOTHESIS**: Which ingredient do you think will produce the most CO2? And why?

**PROCEDURES:**

For this experiment use the temperature that the instructor has prepared.

1. Record the Temperature: Beginning \_\_\_\_\_ °C Ending \_\_\_\_\_ °C
2. Observe height of foam formed/size of balloon, as per time period.

|  |  |  |  |
| --- | --- | --- | --- |
| **Time** | **Sugar 1** | **Sugar 2** | **Control (no sugar)** |
| **5 minutes** |  |  |  |
| **10 minutes** |  |  |  |
| **15 minutes**  |  |  |  |
| **20 minutes** |  |  |  |

**POST-LAB QUESTIONS:**

1. Are the results what you expected?
2. Do you think an increase in temperature would have increased CO2 production? Why?
3. What other ingredients could you use?
4. Design another experiment you could run. Choose a different factor of growth to observe.
5. Graph the CO2 production from the classes’ experiments. (Use time as x-axis and y-axis as CO2 production in mL)



**(AP) ENVIRONMENTAL SCIENCE 2022-23 READING GUIDECHAPTER 10**

REVIEW QUESTIONS

1. What are the general characteristics of renewable energy sources?

2. What percent of world energy comes from renewable energy sources?

3. What renewable energy source provides the majority of renewable energy?

4. List industries that typically make use of the waste they produce to provide themselves with energy.

5. Why is burning of municipal waste to produce energy more common in Europe than in North America?

6. How is the biofuel ethanol produced?

7. List three negative environmental impacts of using biomass to provide energy.

8. What are negative environmental impacts of developing hydroelectric power?

9. Compare a passive solar heating system with an active solar heating system.

10. Describe two different ways sunlight is used to make electricity.

11. List two reasons people oppose additional wind energy development.

12. List three energy conservation techniques.

CRITICAL THINKING QUESTIONS [for APES students only]

1. Imagine you are an official with the Department of Energy and are in the budgeting process for alternative energy research. Decide where you would invest money and explain why you made your choice. What do you think the political repercussions of your decision would be? Why?

2. Do you believe that large dam projects like the Three Gorges Dam project in China are, on the whole, beneficial? Do you believe they are not beneficial? What alternatives would you recommend? Why?

3. Energy conservation is one way to decrease dependence on fossil fuels. What are some things you can do at home, work, or school that would reduce fossil-fuel use and save money?

4. What alternative energy resources that the text has outlined are most useful in your area? How might these be implemented?