**(AP) ENVIRONMENTAL SCIENCE 2022-23 September 26, 2022**

**Today’s Agenda (Day 28)**

1. Housekeeping Items

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1. Homework Check:

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1. Class Activity:

🡪 **DAY 6**: Chapter 3 PPT Review

1. Section 3.4 - Comparing Economic and Ecological Systems
2. Section 3.5 - Using Economic Tools to Address Environmental Issues
3. Section 3.6 - Economics and Sustainable Development

HOMEWORK:

* READ: Chapter 3 – Risk, Economics, and Environmental Concerns
* COMPLETE: Lab – Happy Fishing
* STUDY: **Chapter 3,** Ch 3 & 4 Vocabulary, Chapter 4 Test

CHAPTER 3 VOCABULARY

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Cost-benefit analysis | Deferred costs | Demand | Economics | Ecosystem services | environmental costs |
| Extended product responsibility | External costs | Life cycle analysis | Natural resources | negligible risk | Nonrenewable resources |
| Opportunity costs | Pollution | Pollution costs | pollution prevention | price probability | Renewable resources |
| Resources | Risk | risk assessment | risk management | Subsidy | Supply |
| supply/demand curve | sustainable development |  |  |  |  |

CHAPTER 4 – Matter, Energy and Environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Acid | Activation energy | Atoms | Base | Catalyst | Cause and effect relationships |
| Chemical bonds | Combustion | Compound | Controlled experiment | Electrons | Elements |
| Endothermic reactions | Energy | Entropy | Enzymes | Exothermic reactions | Experiment |
| First law of thermodynamics | Hydroxide ions | Hypothesis | Ions | Isotopes | Kinetic energy |
| Kinetic molecular theory | Latent heat | Law of conservation of mass | Matter | Mixtures | Molecules |
| Neutrons | Nucleus | Observation | pH | Photosynthesis | Potential energy |
| Protons | Pseudoscience | Reproducibility | Respiration | Science | Scientific law |
| Scientific method | Second law of thermodynamics | Sensible heat | Theory | Variables |  |

REMINDERS:

* **TEST:** **Ch 3** 🡪 **~~Sept. 20~~ Sept. 27**
* **QUIZ: Ch 3 & 4 Vocabulary 🡪 Sept. 29**
* LAB: Happy Fishing – Sept. 29
* **TEST:** **Ch 4 🡪 ~~Sept. 29~~ Oct. 13**

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

**Happy Fishing Game**

A picture containing diagram

Description automatically generated

**Background Information:**   In 1968, a scientist by the name of Dr. Garrett Harden coined the concept called the “***Tragedy of the Commons***”.  *“The Tragedy of the Commons”* is a problem that occurs when a resource –*such as the ocean, water, and air*- is open to everyone. Overtime, these resources become *overexploited,* and the consumers face the choice of restricting their own *consumption* for the good of the resource and community or continuing to consume/use the resource opting to face dire consequences at a later time. When people are not compelled to preserve resources for the welfare of future generations, the *Tragedy of the Commons* occurs.

**Lab Objective:**  Students will participate in an activity that will help them better understand the concept of the “***Tragedy of the Commons***” and the difficulties associated with managing these shared resources.

**Preparation:** Divide students into groups of 4 participants. Each group should sit around the "lake” *(common resource).*

**Materials:**

* **Goldfish- Colored**
* **Bowl *(Lake)***
* **Straws *(at least 1 per student)***
* **Plastic spoons *(at least 1 per student)***

**Scenario:** Each one of you represents the head of a family ***(fisherman)*** where the only source of income is to sell your daily fish catch. In order for your family to survive, you must catch enough fishto pay your ***operating costs*** and make profit to pay for your ***living expenses***\*. The only food source is a small local lake, which can accommodate up to **16** fish. You must catch the fish by sucking up the "fish" from the lake with straws ***(fishing pole)*** or using a spoon to scoop up the fish ***(net).*** Each student will get a chance to fish once a year ***(which lasts 30 seconds)*** and each time you fish you may take 0, 1, 2, 3 or 4 fish from the lake. **“It is your choice of how many fish (0-4) you take, however, if you only take one fish, you will not make enough to support your family and pay for your fishing expenses.”** Each fish has a different “redemption value” based on color. After the annual fishing season has ended, any remaining fish will reproduce **once** during the off-season- each remaining fish is able to reproduce and make one new fish ***(based on color- a maximum of 4 each- total of 16).***  If you are unable to catch enough fish to support your fishing activity your game is over. **The student with the most “money” at the end will win a prize.**

**Activity Procedures:**

1. Each student will start with **$25** in ocean currency
2. Students are given the option of fishing gear:
   1. **Fishing pole (straw)** – cost $1 **one-time fee**
   2. **Fishing net (spoon)** – cost $5 **annual fee**
3. Students will get 30 seconds to fish.  **Remember, you must catch enough to support your family and pay your annual expenses** *(at least $20 per year).*
4. At the end of each year *(round)*, the teacher will add an additional goldfish for each fish remaining in the lake. Make sure to add according to the colors remaining.  **Each fish can replicate x 1 each *(for a maximum of 16 in bowl).***
5. At the end of the first fishing season, fill in your worksheet. If you are unable to cover your annual expenses, you are unable to fish the next year. ***You have gone bankrupt and must sit out of the game.***
6. If your group still has fish remaining in the lake, continue to run another annual fishing season ***(Year 2a).***
7. Repeat steps 2 – 5. *Again, if you are unable to cover your annual expenses, you are unable to fish the next year.*
8. Once the fish are exhausted - total up your worksheet.

**Student Rules**

1. **NO TALKING DURING ACTIVITY**
2. Fisherman can only “fish” ***one fish at a time.***
3. *No “hitting” or ‘knocking” other fisherman- will result in a fine (see teacher for details)*

12. Keep all catch fish in front of you- *for teacher to count after round*

13. If you are out of fish or out of money- *you will have to sit out!*

14. **There is a PRIZE for the player that has the most money at the end of the game!!**

**Happy Fishing Budget Sheet** [Refer to Live Spreadsheet Template]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **HAPPY FISHING BUDGET SHEET** |  |  |  |  |
|  |  |  |  |  |
| **Fisherman Name:** |  |  |  |  |
|  |  |  |  |  |
| **Year 1 - Operating Costs/Profits** |  | **Starting Amount:** | $25.00 |  |
| Annual Fishing Fees |  |  | *minus* |  |
| \*Fishing Permit - $5 per year |  |  |  |  |
| \*Boat Maintenance/Fuel/Slip Fees - $5 per year |  |  |  |  |
| \*Cost of Living (rent, food, etc) - $10 per year |  |  |  |  |
| SUBTOTAL: |  |  | **$0.00** |  |
| OPTION: Choose which type of fishing equipment you will use |  |  |  |  |
| \*Fishing Pole (straw) - $1 initial fee **(no annual charges)** |  |  |  |  |
| \*Large Fishing Nets (spoon) $5 **annual fee** |  |  |  |  |
| SUBTOTAL: |  |  | **$0.00** |  |
| **TOTAL OPERATING COSTS (Year 1)** |  |  | **$0.00** |  |
| **\*\*Need at LEAST $20 worth of fish each year to survive\*\*** |  |  |  |  |
|  |  |  |  |  |
| **Year 1 - Fishing Profits** |  |  |  |  |
| \*Goldfish - $5 each | x |  | **$0.00** |  |
| \*Greenfish - $6 each | x |  | **$0.00** |  |
| \*Redfish - $8 each | x |  | **$0.00** |  |
| \*Bluefish - 12 each | x |  | **$0.00** |  |
| **TOTAL PROFITS** |  |  | **$0.00** |  |
|  |  |  |  |  |
| **NET Total for YEAR 1** |  |  | **$25.00** |  |
|  |  |  |  |  |
| QUESTION: Did you make a profit? Did you go bankrupt" |  |  |  |  |
|  |  |  |  |  |
| **Year 2 - Operating Costs/Profits** |  | **Starting Amount:** |  |  |
| Annual Fishing Fees |  |  |  |  |
| \*Fishing Permit - $5 per year |  |  |  |  |
| \*Boat Maintenance/Fuel/Slip Fees - $5 per year |  |  |  |  |
| \*Cost of Living (rent, food, etx) - $10 per year |  |  |  |  |
| SUBTOTAL: |  |  | **$0.00** |  |
| *You would need to pay another fee if you choose to use the nets!!* |  |  |  |  |
| \*Large Fishing Nets (spoon) $5 **annual fee** |  |  |  |  |
| **TOTAL OPERATING COSTS (Year 2)** |  |  | **$0.00** |  |
|  |  |  |  |  |
| **Year 2 - Fishing Profits** |  |  |  |  |
| \*Goldfish - $5 each | x |  | **$0.00** |  |
| \*Greenfish - $6 each | x |  | **$0.00** |  |
| \*Redfish - $8 each | x |  | **$0.00** |  |
| \*Bluefish - 12 each | x |  | **$0.00** |  |
| **TOTAL PROFITS** |  |  | **$0.00** |  |
|  |  |  |  |  |
| **NET Total for YEAR 2** |  |  | **$0.00** |  |
|  |  |  |  |  |
| QUESTION: Did you make a profit? Did you go bankrupt" |  |  |  |  |
|  |  |  |  |  |

Happy Fishing Lab- Tragedy of the Commons

**Discussion Questions**

1.   Did anyone in your group take too many fish?  How did that make you feel?  Did everyone try to take as many as possible?  Why or why not?  ***Does society reward those with the “most”?***

2.   Did anyone sacrifice the # of fish, *for the good of the community*?  ***Why or why not?  Does society ever reward that type of person?***

3. In Game two... **how** did your strategy change, if at all?  ***Does it make a difference to know what the rewards are?***

4.   Is it possible to maximize the number of fish caught/person **AND** the number of fish remaining in the pond **at the same time**? ***Why or why not?***

5.  Think of a **local commons** that you are familiar with. ***[parking lots, bathrooms, bookstalls, etc.]*** Do similar situations arise? **Explain. HOW might those problems be solved?**

6. What are some **natural resources** that are **common** resources?

7.  What are the **global commons**?  Are these being used wisely?  ***Why or why not?***

8. ***What can people do to use these resources most wisely?***

9. Did a particular “type” of fish disappear faster than others? ***How does this relate to “economically valuable” species in nature and their extinction rates?***

**Post-Lab:**

***Briefly summarize*** the results of this simulation and discuss the implications of this simulation on the management of common resources in the environment. ***What were the main ideas of the simulation- what did you learn?*** In your summary, please ***discuss relationships between human societies and the environment*** as well as ***possible methods to remediate overuse*** through cooperation. *What other resource management examples can you think of where this topic is relevant? What would you suggest in these situations?*