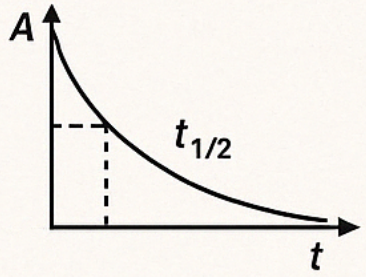
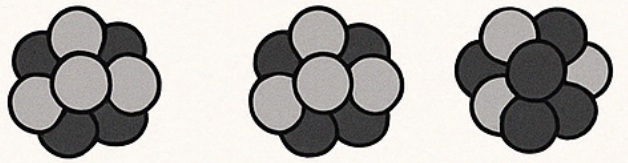
College-Level Environmental Science Problems + Diagrams

Exponential Decay (Radioactive Elements



A scientist begins with 100 grams at a radioactive isotope with a halt-life of 5 years.

Isotopes



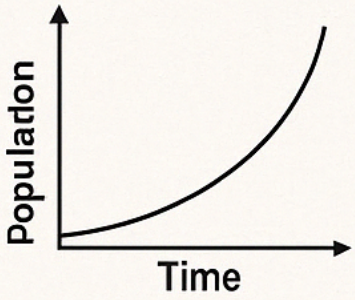
Carbon-12 6 protons

Carbon-14 6 protons

Carbon-14 6 protons

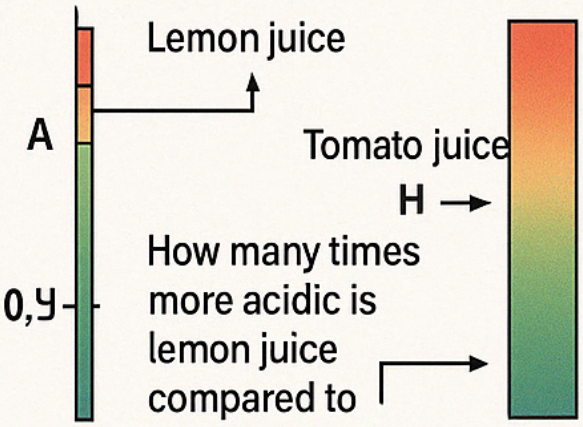
What do they have in common, and how are they different in terms of protons and neutrons?

Exponential Growth (Rule of 70)



A country has a population growth rate of 2% per year. Use the Rule of 70 to estimate how many years it ill take for the population to double.

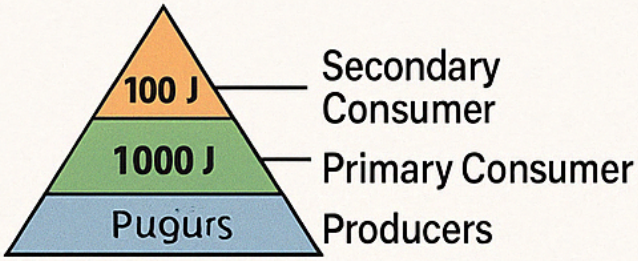
pH (Log Scale)



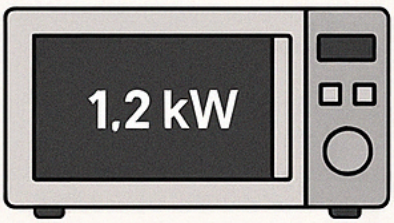
How many times more acidic is lemon juice compared to tomato juice?

If a plant produces 10.000 Joules of energy.

Trophic Pyramids (10 % Rule)



If a plant produces 10.000 Joules of energy, How much energy is available to a secondary consome?



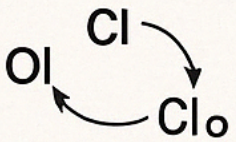
A microwave uses 1.2 kilowatts (kW) of power. If it runs for 30 minutes, How much energy (in kilowatt-hours) does it use?

Ocean Aciditication

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \leftrightarrow H^+ + HCO_3$$

Explain what happens to the pH of ocean water as more CO_2 is absorbed from the atmosphere

Ozone Depletion (Tracking Chlorine)



One chlorine atom from CFCs can destroy thousands of ozone moleules. How does chlorine act as a catalyst

College-Level Environmental Science Problems + Diagrams

College-Level Environmental Science Practice (Fill-in-the-Blank)

1. Exponential Decay (Radioactive Elements)

Uranium-238 has a half-life of 4.5 billion years. If a rock originally contained 1 gram of U-238, how much would remain after 13.5 billion years? Show the number of half-lives and calculate the remaining mass.

Answer: _____

_____

_____

2. Isotopes (Atomic Number and Mass)

A sample contains 92 protons and 143 neutrons. Identify the isotope and write its atomic symbol. Explain how you determined this.

Answer: _____

_____

_____

3. Exponential Growth (Rule of 70)

A city's population increases at an annual rate of 1.4%. Calculate how long it will take for the population to triple using the Rule of 70. Is this method accurate for long-term predictions? Why or why not?

Answer: _____

_____

_____

4. pH (Log Scale)

The hydrogen ion concentration in a solution is 1 x 10^-6 M. Calculate the pH of the solution. Then determine how many times more acidic it is compared to a solution with a pH of 8.

Answer: _____

_____

_____

College-Level Environmental Science Problems + Diagrams

5. Trophic Pyramids (10% Rule)

A trophic pyramid has 1,000,000 J of energy at the producer level. Estimate the energy available at the tertiary consumer level, and describe how this limits ecosystem structure.

Answer: _____

_____

_____

6. Energy vs. Power

A solar panel array generates 3.5 kW of power continuously for 5 hours. Calculate the total energy produced in kilowatt-hours. Then convert this to joules.

Answer: _____

_____

_____

7. Photosynthesis (Tracking Carbon)

In photosynthesis, trace the transformation of carbon from atmospheric CO2 into a glucose molecule. How many CO2 molecules are needed to synthesize one C6H12O6 molecule?

Answer: _____

_____

_____

8. Ocean Acidification

Describe how increased atmospheric CO2 leads to ocean acidification. Include the chemical equilibrium reactions: CO2 + H2O <-> H2CO3 <-> H+ + HCO3-. Explain the impact on marine organisms with calcium carbonate shells.

Answer: _____

_____

_____

9. Ozone Depletion (Tracking Chlorine)

College-Level Environmental Science Problems + Diagrams

Explain the catalytic role of chlorine from CFCs in ozone layer depletion. Include the reactions involved and describe why this process is particularly harmful in the polar stratosphere.

Answer: _____

_____

_____

10. Respiration and Combustion

Compare the enthalpy change of glucose combustion with the energy released during cellular respiration. Why is cellular respiration considered more efficient in energy capture?

Answer: _____

_____

_____

11. Aerobic vs. Anaerobic Respiration

Under anaerobic conditions, muscle cells produce lactic acid. Compare the ATP yield per glucose molecule in anaerobic vs. aerobic respiration and explain the implications for athletic performance.

Answer: _____

_____

_____

12. Efficiency (Work Out / Work In)

A geothermal power plant inputs 5000 kJ of thermal energy and outputs 1100 kJ of electrical energy. Calculate the efficiency. What factors might contribute to the low efficiency in this system?

Answer: _____

_____

_____