AP Environmental science

APES class 2026-2027

- Heat lab: save the thermobacteria!
- Chemistry review

Heat lab: save the thermobacteria!

Challenge:
You are a researcher of volcanic geysers who has just discovered a new species of hot water bacteria, and need to transport a sample of 100°C water from the geyser to the lab. You have the following supplies to achieve your mission:

- several sheets of aluminum foil, one side is shiny, one is dull
- two styrofoam cups
- napkins from a local restaurant
- plastic wrap
- a few plastic bags
- access to toilet paper
- your geyser thermal camera

You will gather a sample of hot bacteria water, then measure the temperature when you reach your lab hours away. The hotter the water, more bacteria have survived for your research. Create a diagram of your "thermobacteria transport device" so others can learn from you!

Lab questions:

1. how did you stop convection, conduction and radiation of heat from your sample?
2. which side of the shiny foil was facing the hot water and why?
3. if you were later studying DO (dissolved oxygen) in a cool water sample, what would you do differently?
4. does the hot water cool at the same rate through your trip? Explain
5. could the thermobacteria be aerobic or anaerobic? Explain
6. why do people warm their thermos with hot water before putting in their hot drink?

Chemistry review

APES 2026-27 notes

APES 2026-27 notes

HW: 9.4.26

1. the coffee cup you pick up at the coffee shop has three modes of reducing heat loss. describe each with a diagram and explain how each reduces the transfer of heat energy
2.

8.24.26 quiz E

1. How many protons, neutrons and electrons in each of these: C13/6, Sr90/38, U234/92
2. What is the new and old name of these symbols: Pb, Na, Fe, Au
3. If a sample of carbon is found to have 25% of the natural amount of C14/6 in it, how old is it? (C14 half life is about 5000 years)
4. List three anomalies from your 8 countries work

8.19.26 Wednesday

quiz:

1. give an example in your life of a positive feedback loop
2. and a negative feedback loop
3. thinking of your body as a system, is it open or closed? explain
4. name two things you found about the country you chose that surprised you

HW notes:

stable orbitals

pool-joule

sun-big bang

steady state?

negative feedback

pos feedback: banana

8 countries summation

Chem review:

3 main characters: proton, neutron, electron (they draw on their notes w/ relative size and charge)

periodic table (print in color):

names

columns

compounds vs. elements

ionic bonds (common)

covalent bonds (copilot)

isotopes: Sr90/38

half-lives

physical properties:

4 states of matter (s, l, g, plasma)

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Homework: 8.19.26

1. what is the connection between geysers and pressure cookers?
2. why would brewing tea be weaker up on Mauna Kea summit?
3. what could carbon change in its electron structure to be stable?
4. which conducts electricity better: ionic or covalent compounds and why? (think of salt water)
5. pick three other isotopes we did not cover in class and list their protons, neutrons and electrons
6. pick six elements that have a name that does not match their symbol, and explain why
7. A dish is found at an ancient ruin that has 1/8 of the background level of C14/6. Look up the half life for C14/6 and determine the age of the relic.
8. if you wanted to dissolve CO2 into water, would you warm or cool the water-explain
9. why does an air conditioner drip water out of the back if it is working?
10. what enables a glacier to move along very rough rock? explain.

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collgative properties: bp, mp, depression——

reglation

geysers——

freeze dried coffee

gas->liquid solubility

capillary action

chemical properties:

pH

carbonic acid

fossil fuels-ocean acidification

methionine->acid rain

cause and effect

8.17.26 notes-systems-HW

https://www.bozemanscience.com/ap-es-002-environmental-systems

1. look up the Aral sea on google earth now, how does it compare with the photo in the video?
2. what is the difference between the energy and matter systems on our planet?
3. give an example in your life of an open system and a closed system (could be money, you name it)
4. thermodynamics uses the term “energy tax”, explain
5. what makes elements reactive?
6. why are noble gases stable?
7. a friend tells you that swimmers warm up the pool two ways-is he crazy?
8. go ALL the way back: where does all of our energy come from?
9. before we started burning fossil fuels was earth a steady state? explain.
10. give an example in your life of a positive and a negative feedback loop

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8.17 Monday

HW: https://www.bozemanscience.com/ap-es-002-environmental-systems

8 countries summation

quiz: 8 countries

periodic table

names

formulas: MgCl?

half lives

Sr90

pH

capillary action

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gas->liquid solubility

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It is May 2027, and you have been successful in this course.

What does success look like?

What did you do to be successful?

survey questions:

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3. what is a negative feedback loop?
4. how many protons, neutrons and electrons are in Sr90/38?
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6. how much stronger is pH 3 than pH 5?
7. are these acids or bases?
8. the half life of Sr90 is about 30 years, so how much of an original sample is left after 60 years?
9. what are the boiling point and melting point for water in °C?
10. what gas in the atmosphere causes ocean acidification?
11. you put 1000J of energy into your car gas tank, and get 1200J of energy out of your car- what is wrong with this?
12. is sweating a negative or positive feedback loop? explain
13. if Kona is 60 km away, how many cm is this?
14. what are the names of these symbols: Hg, Na, Fe, K
15. what are the charges on an electron, a neutron and a proton?
16. what is osmosis?
17. if a person’s mass is 220 lb and each kg is 2.2 lb, how many kg are they?

18. what is the square root of 144?
19. what is the log10 of 1000?
20. what is the difference between radiation, conduction and convection?

(change for second section)

8.13.26

8 countries: how would you pair the countries?

why were they chosen?

need science base HW survey

video:

planetary boundaries

pie chart: climate change red

apes different from other courses:

ecological footprint

quiz::

1. from the video, why is apes different from other science courses?
2. what was your global footprint (earths)
3. why do we use “earths” as a measure? what does it mean?
4. create two fictional students at HPA: one with very low footprint, one with very high footprint-explain why

class:

review video

8 countries-how would you pair them?

science survey HW-weekend

in-class calculators-show

hw:

science survey questions (no ai)

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1. FedEx sign: can’t NOT see it now, APES will change how you think
2. I will do my best to read everything you write
3. I bring my A game. I know you are busy, but I expect you to bring yours as well, and I'll let you know when I think you are not.

60-30-10 quiz, hw, lab

delete one HW per semester

AI Policy; research helper, if your name is on it, it has to be YOUR thoughts

metaphor: sending a robot to the gym for you vs. robot training partner

I read everything and comment

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AP exam-iPad prep

cause and effect

show your work

demonstrate understanding, not canonical learning

this course will change how you think: FedEx icon

Round grades to whole number, not decimals

34 classes per semester

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case studies: deepwater horizon

How we teach in HS is about recall. college is about synthesis and context

derivation…

Homework:

Email bill@hpa.edu

1. where is home besides HPA?
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HW: bozeman intro. **cause and effect**

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login is hpa/papaya77

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Your global footprint—

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seeding project:

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look up bluetooth icon: why runes?

https://www.livescience.com/planet-earth/nasa-satellite-captures-wave-of-warm-water-hundreds-of-miles-long-that-signals-a-devastatingly-strong-el-nino

Footprint investigation:

https://data.footprintnetwork.org/#/countryTrends?cn=5001&type=BCtot,EFCtot

Questions:

- check out the vertical axes
- where would be a good place to live when you are 40?
- when did they move from surplus to debt?

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Ask any math professor why hundreds of thousands of STEM majors fail Calculus I every fall, and they'll share a secret: students aren't actually failing calculus. They're failing algebra.

This foundational weakness is one of three systemic hurdles that turn this course into a gatekeeper:

The Algebra Deficit
A typical problem involves one step of actual calculus—such as applying the power rule or the chain rule—followed by multiple steps of algebraic simplification. Students arriving from high school often harbor fundamental weaknesses in factoring, manipulating rational functions, or deploying trigonometric identities. When they encounter a complex derivative, they execute the new calculus concept correctly but lose points on the algebraic mechanics required to finish the problem.

The Rote Memorization Trap
High school mathematics is frequently taught as a set of algorithms to memorize. Students learn how to execute formulas without necessarily understanding the underlying logic. University calculus demands conceptual understanding and mathematical rigor. A student who expects to pass by recognizing patterns and memorizing templates will struggle with university exam

questions designed to test the application of concepts to novel, unfamiliar scenarios.

The "Weeder" Environment
Calculus I is often structured as a gatekeeper course for competitive engineering, physics, and computer science programs. Instruction typically occurs in massive lecture halls where the pace is unforgiving. A topic that a high school teacher might spend three weeks covering is often compressed into a few days at the university level. Because the material builds cumulatively, a student who fails to grasp limits in week two is almost certain to fail integrals in week ten.

To address these attrition rates, mathematics departments are rethinking how the course operates:

- **Co-requisite Remediation:** Instead of diverting students into zero-credit remedial algebra courses, universities place them directly into calculus with a simultaneous "just-in-time" support lab. Instructors review trigonometric identities in the exact week the main lecture covers derivatives of trigonometric functions.
- **Active Learning:** Institutions are replacing passive lectures with active learning models. Flipped classrooms—where students watch video lectures as homework and spend class time solving problems in small groups guided by teaching assistants—consistently yield lower failure rates.
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