



CHRISTOPHER COLUMBUS

A Marist Brothers High School 1958



AP Environmental Science summer assignments 2026

This is a three-part assignment:

1) PART ONE **Due August 17 or 18, 2026 - depending on which period**

In the textbook (on Shelfit - OnCampus) - Read unit one - pages 15 - 92 - (1) read the case study - pages 15- 18 (Growing Grapes to Make Fine Wine) and **write a paragraph** (minimum 5 sentences) summary AND **answer the questions** from “Practice your science skills” on page 18 (incomplete sentences) - (2) **answer the questions** on “Do the Math” - your turn pages 12, 38, 61, 64 and 70 (this is a digital textbook so you might have to scroll up or down to find the section) (3) **Practice your math** pages 41, 65 & 82 and **practice math and graphing** pages 41, 65 & 82 and (4) **answer the Free Response Questions** on pages 28, 43, 50, 58 & 82 (5) Read - Pursuing Environmental Solutions - ‘The Practice of Precision Agriculture’ - **answer Critical Thinking Questions** ***incomplete assignments receive a grade of 50***- FYI - it is a give away that you haven’t read the entire unit if you say you can’t find these sections 😊
- **Handwritten on paper** - due the first day of class **August 17/18, 2026. ***your first day in class**

2) PART TWO **Due August 18 or 19, 2026**

Two (2) journal articles (**attached here - scroll down**) –*What Happens to the Natural World if all the Insects Disappear* – Conversation – The New York Times and Anthropocene - Fixing Carbon -**The Biggest Carbon Sink of All** – **annotate** (each section completely) each article and **write a summary** of the major takeaways (2 Assignment grades) -***incomplete assignments receive a grade of 50*** - UPLOAD each article separately to a notability file and name the file (last name, first name, Period #, short name of article) - these will be two (2) separate uploads to OnCampus **August 18/19, 2026. ****your first day in class**

3) PART THREE ***Due August 18 or 19, 2026***

Name: _____ APES Class Period: _____

Home Energy Audit Electricity Consumption

Objectives

- 3) Conduct an energy audit/survey of electrical appliances in your home, in terms of the energy used and the costs involved.
- 4) Determine the amount of energy used by different appliances.
- 5) Interpret a monthly electric bill.
- 6) Make calculations and conversions relating to energy use.
- 7) Increase your understanding of energy units such as watts, volts, amps, and kilowatt-hours.
- 8) Design and implement a specific strategy or conservation plan that will lead not only to a reduction in the amount of electricity that you use, but also to a lower monthly cost.

Introduction

Electrical consumption has gone up in the United States over the last 50 years for a number of reasons, including increased per capita demand and commercial and industrial demand from economic expansion. While the number of Americans grew by 87 percent from 1950 through 2000 (from under 150 million to almost 280 million), their energy consumption expanded by a much greater 194 percent.

At the same time, some traditional sources of fuel for electrical generation have stagnated or even fallen. In the energy mix today, natural gas is the dominant fossil fuel for the production of electricity. In 2020, about 38% of our electricity was from natural gas. Petroleum now supplies very little electricity in the U.S., less than previously. Coal supplies about 23% of our electricity.

Nuclear electric power did not exist in this country until 1957. The new industry expanded rapidly until the 1979 accident at Three Mile Island in Pennsylvania and the Chernobyl catastrophe in Ukraine in 1986. As fewer new units came on line and old units began to shut down, the number of operable units fell to 58 in 2019. Today about 20% of our electricity is from nuclear power, a portion currently in a downtrend.

Renewables provide about 18% of our electricity in the United States. Wind and hydroelectric power each account for about 7%. Solar and biomass provide less than 2% of the electric generation.

Our personal use of electricity is very small when compared to the total used in the United States today, and personal consumption of fuels is equally small. But as you have seen in other investigations, when the small amounts used by individuals are added up, they become a very significant value for a large population. Personal decisions about how much energy to use or save and which sources to depend on are very significant.

(Data Source: <https://www.eia.gov/tools/faqs/>)

***I would download these sheets into notability and cut/paste which ones I needed - add pages/sheets to the end to answer questions - HANDWRITTEN in notability - no typing (any kind of font) will be accepted.

Data/Observations/Analysis

Before starting this activity, make a list of what you consider to be the top 10 items in your home, in terms of their electricity consumption, going from the most to the least.

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

1. On the chart below, record the amount of time you use each appliance each day along with the power in Watts. Divide by 1000 to convert it to kW. If an appliance is used a few times a week or less, pro-rate it to daily use (divide the number of hours used per week by 7). Add any other appliances that you use regularly to the list. You can determine their power by doing one of the following:
 - Search for the appliance or device online, you may be able to find information about its power, here are some resources:
 - [Appliances](#)
 - [Miscellaneous Devices](#)
 - Look at the appliance label - it may list the power, or it may give you the volts and amps. Multiply volts by amps to determine the power (in watts). Add these to the list. Convert the watts to kilowatts (if necessary) and multiply by the time used to get kilowatt-hours/day, then multiply to get the cost per appliance per day.
2. Determine your household's cost for electricity. You can get this by asking to see a copy of your house's utility bill. If you can't get a copy of the utility bill, you can use my cost which is .123\$/kWh. Multiply the energy used/day (kWh) X the cost of electricity (\$/kWh) to determine daily cost of using that device.
3. Total each column to determine your overall energy use.

Obviously the power ratings in the chart are averages, there are many specific types of these devices

Appliance	Power (W)	Power (kW)	Number of hours/day	Energy/day (kWh/day)	Cost @ _____ cents per kWh
Air conditioner					
Washing machine					
Dryer					
Dishwasher					
Refrigerator					
Blender					
Coffee maker					
Appliance	Power (W)	Power (kW)	Number of hours/day	Energy/day (kWh/day)	Cost @ _____ cents per kWh
Food processor					
Microwave					
Mixer					
Toaster					
Desktop computer					
Laptop computer					
Alarm clock					
TV					
Stereo					
DVD player					
Hair dryer					
Iron					
Fan					
Vacuum cleaner					
Light bulb					
Gaming System					
LED light strip					
Galaxy Lights					

Appliance	Power (W)	Power (kW)	Number of hours/day	Energy/day (kWh/day)	Cost @ _____ cents per kWh
TOTALS					

- Now take a look at your completed table and see how it compares to what you thought would be the top ten, most to least. Did you correctly pick the most energy intensive appliances? What surprised you about your personal energy usage?
- Choose a device that you personally use frequently. Search to find a more efficient version of that appliance. How would switching to that device reduce your energy usage?
- Number of occupants in your home: _____

Use the following equivalences in calculating answers to the exercises below. Be sure to show the steps of your work, including set-ups and proper units, as well as final answers.

Conversion Factors

- **1mWh = 1000 kWh**
- **1 kWh = 3.41×10^3 BTU** (British Thermal Units)
- 1 BTU = 2.93×10^{-4} kWh
- 1 BTU = 1,055 J (joules)
- 12,000 BTU = 3.52 kWh = 1.27×10^7 J

- 1 pound bituminous coal = 12,000 BTU
- 1 barrel oil = 5.6×10^6 BTU = 5.91×10^9 J
- 1 ft³ natural gas = 1,030 BTU = 1.09×10^6 J
- 1 g ²³⁵U = 4.0×10^7 BTU = 4.22×10^{10} J

- How much electrical energy do you consume each day, on average? How much would that be each year?
- Suppose the electricity in your region was supplied by the burning of natural gas.
 - How many cubic feet of natural gas is needed to support your energy lifestyle?
 - 1,000 ft³ of natural gas contains about 20.2 kg of methane. When burned completely it produces 122 lb of carbon dioxide. How much methane would you consume in one year, and how many pounds of carbon dioxide would you produce?
- Suppose coal were used in the generators instead of natural gas.
 - How much coal would be burned to provide your energy?
 - When coal is burned, about 2.3 lb of CO₂ is produced for every kilowatt of electrical energy consumed. How much carbon dioxide would be produced by your yearly electricity use?

4. Suppose the electrical power was produced by nuclear power. How much uranium would be needed for your yearly consumption?
5. Calculate comparative costs.
 - a. The cost for U_3O_8 the primary nuclear reactor fuel, is \$30.00 per pound, or about \$0.07 per gram. What would be the cost of the uranium to generate your electricity?
 - b. Coal costs about \$38.53 per ton, and the cost of natural gas for electric utilities, on the average, is about \$3.25 per 1,000 cubic feet. Calculate the cost of these two fuels to produce your yearly electricity.
6. Compare the pros and cons of using these fuels to produce electricity on a large scale.
 - a. Is the cheapest fuel necessarily the best choice? Explain your reasoning in economic, social, and environmental terms.
 - b. Discuss in some detail extraction, processing, transportation, burning, waste products, and health and safety aspects of the problem.

Visit the NY Times website [“How does your state make electricity?”](#) Read the article and then choose your state from the drop down menu. Use this information to answer the following questions

7. How has electricity production in the US as a whole changed over the last 20 years?
8. Do these changes vary by state or region? If so, why do you think this is so? If not, why is it so consistent?
9. What is the mix of energy used in your state? How has it changed over the past 20 year
10. Predict what the mix of energy sources might be in 20 more years? Justify your prediction.

****** label, label, label - complete sentences – essay style answers (complete sentences paragraph style) – will be turned in your first day of school – please have it in a PDF format ready to be submitted.**

******* Each part is worth at least 1 Assignment grade for a total of 4 grades -**



Part 1 – ***Due August 18 or 19, 2026***

- i. **Unit one** - Read Unit one 1-92 -
- ii. **Read** the case study - pages 16- 18 (Growing Grapes to Make Fine Wine) and **write** a paragraph (minimum 5 sentences) summary - **answer the questions** Practice your science skills
- iii. **Answer** the questions on “Do the Math” - **pages 12, 38, 61, 64 and 70 (this is a digital textbook so you might have to scroll up or down to find the section)**
- iv. **Practice your math** pages 41, 65 & 82 and **practice graphing** pages 41, 65 & 82
- v. **Answer** the Free Response Questions on pages 42, 50, 58 & 72
- vi. **Read** Pursuing Environmental Solutions -’The Practice of Precision Agriculture’ -page 85 - **answer** Critical Thinking Questions

**** **label, label, label** - complete sentences – essay style answers (complete sentences paragraph style)

August 18/19, 2026. ******your first day in class**

handwritten on paper - last name, first name, period each part labeled

Part 2 -***Due August 18 or 19, 2026***

Please upload the **annotated** articles and summaries as **two (2) different PDFs** to OnCampus before **August 18/19, 2026.** ******your first day in class**

*Each article has its own submission box - so download the articles into notability - a notability file for each article - annotations include underlining or highlighting and *short notes* on the side which identify a **major topic or important concept**.

What happens to the natural world if all the insects disappear?

February 18, 2019 7.42am EST

Sergey Ryzhov/Shutterstock

What happens to the natural world if all the insects disappear?

February 18, 2019 7.42am EST

woodlice – and there are probably about 7m species in all.

Despite their ubiquity in the animal kingdom, a recent report warned of a

There are an awful lot of insects. It's hard to say exactly how many because 80% haven't yet been described by taxonomists, but there are probably about 5.5m species. Put that number together with other kinds of animals with exoskeletons and jointed legs, known collectively as arthropods – this includes mites, spiders and

“bugpocalypse”, as surveys indicated that insects everywhere are declining at an alarming rate. This could mean the extinction of 40% of the world's insect species over the next few decades.

What is particularly worrying is that we don't know exactly why populations are declining. Agricultural intensification and pesticides are likely a big part of the problem, but it's certainly more complicated than that, and habitat loss and climate change could also play a part.

Although some newspaper reports have suggested that insects could “vanish within a century” total loss is unlikely – it's probable that if some species die out, others will move in and take their place. Nevertheless, this loss of diversity could have catastrophic consequences of its own. Insects are ecologically important and if they were to disappear, the consequences for agriculture and wildlife would be dire.



A common Jezebel butterfly (*Delias eucharis*) sucks nectar from a flower in Jammu, India. EPA-EFE/Jaipal Singh

The sprawling kingdom of bugs

It's difficult to overstate how many species there are. Indeed, the 7m estimate above is likely a major underestimate. Lots of insects that look alike – so-called “cryptic species” – are distinguishable only by their DNA. There are an average of six cryptic species for every easily recognizable kind, so if we apply this to the original figure, the potential total number of arthropods balloons to 41m.

Even then, each species has multiple kinds of parasites which are mostly specific to just one host species. Many of these parasites are mites which are themselves arthropods. Conservatively allowing just one kind of parasitic mite per host species brings us to a potential total of 82m arthropods. Compared with only around 600,000 vertebrates – animals with backbones – that's 137 species of arthropod for every vertebrate species.

Astronomical numbers like these caused the physicist-turned-biologist Sir Robert May to observe that “To a good approximation, all [animal] species are insects.” May was good at guessing big numbers – he became the UK Government's chief scientist – and his quip in 1986 now seems pretty close to the mark.

Read more: Insect 'Armageddon': five crucial questions answered

That's just diversity though. How many individual insects would be lost in a mass extinction? And how much might they weigh? Their ecological importance will likely depend on both measures. It turns out that insects are so numerous that even though they are small, collectively their weight far outstrips that of the vertebrates.

Perhaps the most celebrated ecologist of his generation, the Harvard ant enthusiast E.O. Wilson estimated that each hectare (2.5 acres) of Amazonian rainforest is inhabited by only a few dozen birds and mammals but well over one billion invertebrates, almost all of which are arthropods.

That hectare would contain about 200 kg dry weight of animal tissue, 93% of which would be made up of invertebrate bodies, and a third of that being just ants and termites. This is uncomfortable news for our vertebrate-centric view of the natural world.



The two-banded chameleon (*Furcifer balteatus*) stalks insects in the Madagascan rainforest. Ryan M. Bolton/Shutterstock

The wriggling foundations of life

The role allotted to all these tiny creatures in the grand scheme of nature is to eat and be eaten. Insects are the key components of essentially every terrestrial food web. Herbivorous insects, which make up the majority, eat plants, using the chemical energy plants derive from sunlight to synthesize animal tissues and organs. The job is a big one, and is split into many different callings.

Caterpillars and grasshoppers chew plant leaves, aphids and plant hoppers suck their juices, bees steal their pollen and drink their nectar, while beetles and flies eat their fruits and devastate their roots. Even the wood of huge trees is eaten by wood-boring insect larvae.

In turn, these plant-eating insects are themselves eaten, being captured, killed or parasitised by yet more insects. All of these are, in their turn, consumed by still larger creatures. Even when plants die and are turned to mush by fungi and bacteria, there are insects that specialise in eating them.

Going up the food chain, each animal is less and less fussy about what kind of food it will eat. While a typical herbivorous insect might consume only one species of plant, insectivorous

animals (mostly arthropods, but also many birds and mammals) don't much care about what kind of insect they catch.

This is why there are so many more kinds of insect than birds or mammals.



A European bee-eater (*Merops apiaster*) catches a dragonfly. Aaltair/Shutterstock

Because only a small fraction of the material of one kind of organism is transformed into that of its predators, each successive stage in the food chain contains less and less living matter. Even though efficiency in this process is known to be greater higher up the food chain, the animals “at the top” represent only a few percent of the total biomass. This is why big, fierce animals are rare.

And so it's obvious that when insect numbers decrease everything higher up in the food web will suffer. This is already happening – falling insect abundance in Central American tropical forests has been accompanied by parallel declines in the numbers of insect-eating frogs, lizards and birds. We humans ought to be more careful about our relationship with the little creatures that run the world.

As Wilson commented:

The truth is that we need invertebrates, but they don't need us.

Knowing about insects and their ways is not a luxury. Wilson's friend and sometime colleague Thomas Eisner said:

Bugs are not going to inherit the earth. They own it now.

If we dispossess them, can we manage the planet without them?



Image: @jasondecairestaylor | www.underwatersculpture.com

Fixing Carbon
Dispatches from an emerging future

The Biggest Carbon Sink of All

Can we bury our CO2 problem at the bottom of the ocean?

By **Mark Harris**

May 19, 2022

—One of the brightest hopes for sequestering carbon lies in the darkest place on earth: the abyssal depths of the deep ocean. For millennia, dead plants and animals have sunk to the bottom of the sea, where they form sediment that eventually turns into rock (and sometimes fossil fuels).

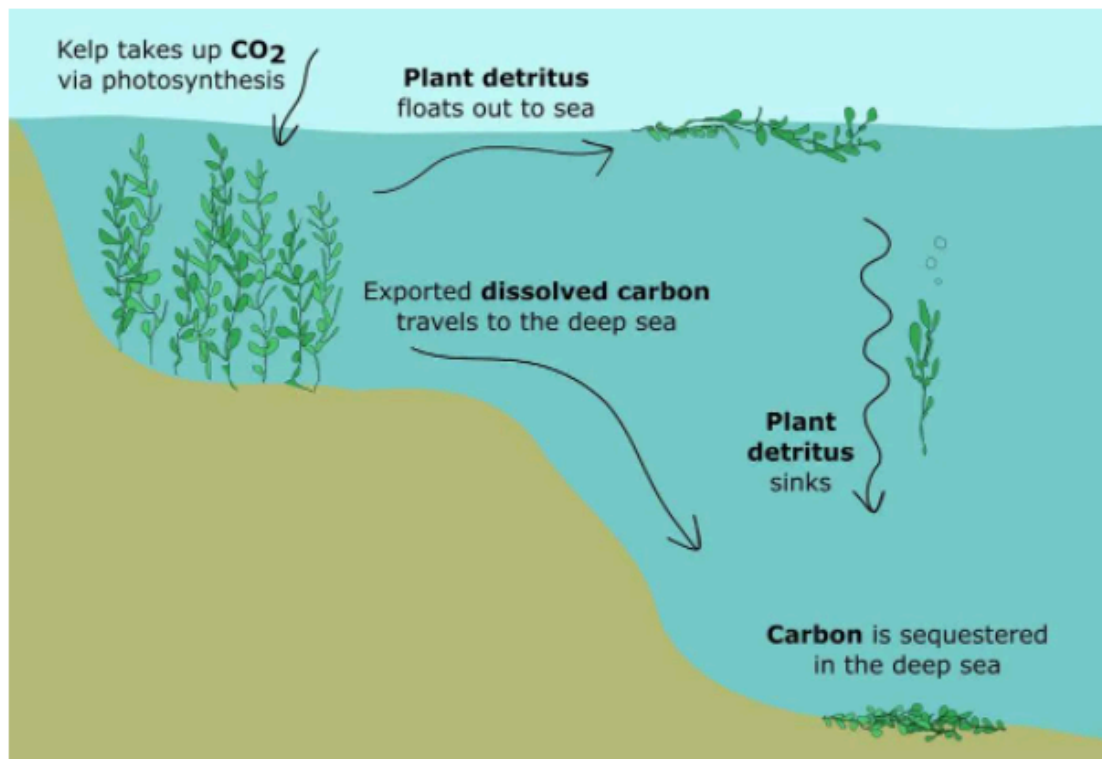
Some climate researchers think we can now accelerate this natural process and clean up our modern carbon mess by deliberately sinking millions of tons of seaweed and fish.

But is carbon sinking the climate equivalent of sweeping dirt under the rug? Our knowledge of deep-sea ecosystems is still sketchy; and even if the carbon math works out, the logistics of sinking carbon could disrupt the marine systems we rely on for food, transport, and recreation.



A Natural Solution As Vast As The Problem

1. **Sinking seaweed.** A 2016 paper in Nature Geoscience estimated that marine macroalgae—aka seaweed or kelp—could store around 175 million tons of carbon each year, either by burying it in coastal sediments or exporting it to the deep sea. In 2020, the Energy Futures Initiative, a climate tech non-profit, published a report that found marine carbon dioxide removal could one day sequester CO₂ at a billion ton scale, thanks to the sheer amount of available space in the ocean and the absence of land use complications.



Pathways for sequestration of macroalgae carbon into the deep sea.

Figure was adapted from Krause-Jensen and Duarte, 2016.

2. Just add water (and money). There seem to be no major technical barriers to farming seaweed, which can [grow at almost 3 centimeters an hour](#). Several start-ups are already experimenting with growing or moving coastal kelp far out to sea, where it would settle to the ocean floor instead of washing up on shore. [Running Tide](#) is using carbon buoys to suspend kelp “microforests” above deep water: when the buoys are deflated, the kelp naturally sinks. [Pull to Refresh](#) wants to use semi-autonomous solar-powered vessels to grow and sink its carbon-sucking seaweed.

3. Scaling back on industrial fishing. Gaël Mariani, a marine ecologist at the University of Montpellier [has calculated](#) that big fish like tuna also sink to the seafloor when they die—and that global fishing has interrupted that natural process to the tune of 730 million tons of CO₂ since 1950. Letting the big ones get away can be a win for carbon.

The Numbers Are Still Murky

1. The science ebbs and flows. The 2016 Nature paper estimated that a square kilometer of seaweed absorbs around 50 tons of carbon. But when University of Tasmania scientist John Barry Gallagher [ran the numbers, he was surprised to find](#) that kelp forests are actually a net source of carbon. He [calculates](#) that tiny sea creatures feeding on seaweed breathe out their own CO₂, meaning a square kilometer of kelp actually emits an average of 20 tons. His [helpful article](#) from March suggests more research is needed before we scale up seaweed farms.

2. **The detail is in the weeds.** In this [excellent MIT Technology Review article](#) from last year, James Temple attempts to untangle the prospects for kelp carbon removal. He notes that scholars worry about a billion-ton blue carbon effort blocking the paths of marine mammals, disrupting local ecosystems, interfering with shipping, and encroaching on protected areas and indigenous territories.

3. **Don't sink it, eat it.** Any discussion of kelp is complicated by its growing popularity as a climate-friendly [agricultural foodstuff](#), [biofuel](#) and replacement for plastics. These reduce the world's carbon footprint but are only carbon-neutral solutions: recycling carbon dioxide already in the atmosphere rather than permanently removing it. To sink and sequester the kelp instead, a generous carbon price (or other incentive) would be needed to make it a more attractive option.

What To Keep An Eye On

1. **Early experiments.** Running Tide has already deployed about 1600 kelp buoys, and you can now [buy its "carbon-negative" oysters online](#).

2. Kelp Coins. Whether you consider “a unique, serialized digital security token comprising a forward contract on a ton of seaweed” to be a great way of building natural capital based on marine permaculture, or another example of cryptocurrency gone mad, it will be interesting to see what happens to the Kelp Coin’s \$200 face value when it matures (at a so-far unspecified point in the future).

3. Public and political pushback. In 1990, protestors managed to prevent a seaweed farm intended to produce nori for the then-hottest food trend of sushi from going ahead in Washington State. Permitting is still a big issue for kelp cultivation—although Washington recently advanced a bill to streamline regulation.