COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Literacy

GRADE 9-10 LITERACY IN SCIENCE:

VERTICAL FARMING

UNIT OVERVIEW

This unit on photosynthesis and vertical farming will teach students about the role of photosynthesis in creating much of the food needed for life on Earth. In addition, students will come to realize how changing our approach to how we grow our food can change the impact we have on the environment around us. This unit on metabolism takes place after students have background knowledge in cell process, homeostasis, and ecology. It is aligned with New York State Living Environment Science Standard 4, Key Idea 5: Organisms maintain a dynamic equilibrium that sustains life. Using their knowledge about the role of photosynthesis in creating food, students will do guided research on vertical farming, culminating in an argument task in which they argue whether vertical farming is a viable industry for New York City.

TASK DETAILS

Task Name: Vertical Farming

Grade: 9-10

Subject: Living Environment

Depth of Knowledge: 3

Task Description: The task asks students to write a policy brief for a local congresswoman in order to inform her about vertical farming and its viability in New York City. Students craft a claim and support their claim with evidence and reasoning.

Standards Assessed:
WHST.9-10.1 Write arguments focused on *discipline-specific content*.
a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
e. Provide a concluding statement or section that follows from or supports the argument presented.

Materials Needed:
"Ocean Acidification," National Geographic.
http://ocean.nationalgeographic.com/ocean/critical-issues-ocean-acidification/

El Nasser, Haya. "World Population Hits 7 Billion." *USA Today*, October 30, 2011.
http://www.usatoday.com/news/world/story/2011-10-30/world-population-hits-seven-billion/51007670/1

NYC Department of Education
Dennis M. Walcott, Chancellor

Owen, James. "Farming Claims Almost Half Earth's Land, New Maps Show." National Geographic News, December 9, 2005. http://news.nationalgeographic.com/news/2005/12/1209_051209_crops_map.html

Despommier, Dickson. *The Vertical Farm: Feeding the World in the 21st Century.* New York: Picador, 2011.

Kretschmer, Fabian, and Malta E. Kollenberg. "Can Urban Agriculture Feed a Hungry World?" *Der Spiegel*, July 22, 2011. http://www.spiegel.de/international/zeitgeist/0,1518,775754,00.html

Max, Arthur. "Future Farm: A Sunless, Rainless Room Indoors." AP, April 16, 2011. http://www.usatoday.com/money/smallbusiness/2011-04-16-indoor-farming.htm

Venkataraman, Bina. "Country, the City Version: Farms in the Sky Gain New Interest." *New York Times*, July 15, 2008. http://www.nytimes.com/2008/07/15/science/15farm.html

TABLE OF CONTENTS

The task and instructional supports in the following pages are designed to help educators understand and implement Common Core–aligned tasks that are embedded in a unit of instruction. We have learned through our pilot work that focusing instruction on units anchored in rigorous Common Core–aligned assessments drives significant shifts in curriculum and pedagogy. Callout boxes and Universal Design for Learning (UDL) support are included to provide ideas around how to include multiple entry points for diverse learners.

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Acknowledgments: This bundle was developed by a teacher team led by Patrick Whelton at NYC public school 02M413. It was reviewed for CCLS alignment by the NYC Common Core Fellows.

GRADE 9-10 LITERACY IN SCIENCE:

VERTICAL FARMING

PERFORMANCE TASK

NYC Department of Education
Dennis M. Walcott, Chancellor

Vertical Farming Policy Brief Final Task

Introduction

Your tenure as an aide to United States Congresswoman Carolyn Maloney is going along smoothly (remember that she represents eastern Manhattan as well as parts of Queens). You have the opportunity to offer her ideas for new laws and legislation.

While working, you come across several articles about vertical farming. Working for a representative in New York City, you realize that this is an issue of which your boss should be aware. Thus, your task is to write a policy brief about whether or not New York City should begin to pursue vertical farming on at least some of the city's vacant lots (almost 9,000 acres worth in New York City).

Your policy brief should contain the following:

- **An overview of vertical farming and how it works.**
  - How does farming/plant growth actually work?
  - What reactions and/or structures are involved in plant growth?
  - Should plants be able to grow according to the principles of vertical farming?
  - Under what conditions will plants grow indoors?
- **Advantages and disadvantages of vertical farming.**
  - What are the benefits of vertical farming?
  - What are the drawbacks of vertical farming?
  - Who are the stakeholders in NYC affected by decisions about vertical farming?
  - What might their opinion be and how might they be affected?
  - If vertical farming is going to be carried out on a large scale, then can your knowledge of photosynthesis and the factors that affect it be useful for developing more efficient plans?
- **Your views on vertical farming**. State a precise claim, distinguish it from the opposing view (counterclaim), and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
  - Do you claim that it is an viable option worth pursuing in New York City? Or do you claim that it will not have any meaningful impact on the city? Or do you claim something different?
  - Develop your claim and the counterclaims fairly. Give evidence for both sides and note the strengths and weaknesses of each.
  - Be sure to use specific vocabulary (about photosynthesis, light, etc.) that you learned during the unit.
  - Provide a sense of closure that follows from and supports your views.
  - Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- **Reference at least 2 or 3 texts** on vertical farming that we read throughout the unit as you draw evidence to support your analysis, reflection, and research.
- **Include an APA formatted bibliography.**
- Remember you are writing to Congresswoman Maloney, so your **writing should be developed, organized, and in a style that is appropriate to your audience.**

GRADE 9-10 LITERACY IN SCIENCE:

VERTICAL FARMING

RUBRIC

The following rubric assesses student performance for the Vertical Farming Performance Task. It has been aligned to Common Core standards WHST.9-10.1.

NYC Department of Education
Dennis M. Walcott, Chancellor

Final Task Rubric

Score	Criteria
4 (Exceeds Standards)	- Introduces precise, well-informed claim about vertical farming in NYC - Clearly establishes the significance of the claim by addressing and precisely describing the problem - Creates an organization that logically sequences the claim(s), counter-claims, reasons, and evidence - Provides a concluding statement/section that follows from and enhances the argument presented - Develops claim and counterclaims fairly and thoroughly with logical reasoning - Supplies only relevant and very persuasive evidence to support claim and counterclaims - Establishes and maintains a formal style and objective tone - Demonstrates a strong command of the conventions of standard English
3 (Meets Standards)	- Introduces precise claim about vertical farming in NYC - Establishes the significance of the claim by addressing the problem clearly - Creates an organization that logically sequences the claim(s), counter-claims, reasons, and evidence - Provides a concluding statement/section that follows from and supports the argument presented - Develops claim and counterclaims fairly with logical reasoning - Supplies relevant and persuasive evidence to support claim and counterclaims - Establishes and maintains a formal style and objective tone - Demonstrates a consistent command of the conventions of standard English
2 (Approaches Standards)	- Introduces basic claim about vertical farming in NYC - Introduces the significance of the claim - Organizes the reasons and evidence logically - Provides a concluding statement/section that follows from or supports the argument presented - Develops claim fairly with logical reasoning - Supplies evidence to support claim - Establishes and maintains a formal style - Demonstrates adequate command of the conventions of standard English
1 (Needs Major Revisions)	- Introduces or implies a vague claim about vertical farming in NYC - Acknowledges the significance of the claim - Organizes the reasons and evidence - Provides a concluding statement/section that follows from or supports the argument presented - Develops claim with logical reasoning - Supplies evidence to support claim - Establishes and maintains a formal style - Demonstrates adequate command of the conventions of standard English

GRADE 9-10 LITERACY IN SCIENCE:

VERTICAL FARMING

ANNOTATED STUDENT WORK

This section contains annotated student work at a range of score points and suggested next steps for students. The student work shows examples of student understandings and misunderstandings of the task.

Grade 9-10 Literacy in Science: Vertical Farming
Annotated Student Work

Student A: Level 3

Vertical farming policy brief

Overpopulation is estimated to occur in the next few decades. About 3 billion more people will live on this planet in the near future, adding up to almost 10 billion individuals. ("The vertical farm"). The main issue of this overpopulation is the food shortage. Dickson Despommier, a professor at Columbia university, has brought about the idea of vertical farming. Vertical farming is the concept of indoor agriculture that will take place in a several stories high building, which will also cover a full block, in the middle of the largest urban centers (such as New York city). Each floor will be used for a different type of plant and will be taken care of meticulously by precise steps : planting, then monitoring the growth, and finally harvesting. Temperature and lighting will be adjusted to each plants needs. Sunlight will be replaced by LED lights (most likely using the color white, blue, red since these help the plants in the process of photosynthesis more effectively then other lights). Vertical farming will be a worthwhile project because it replaces the thousand of crop acres by simple buildings, it recycles water, and it protects the food from weather hazards.

With the extremely high risk of overpopulation, the amounts of acres of crops used for agriculture will indeed increase in the next years. "Given current agricultural productivity rates, the Vertical Farm Project estimates that an agricultural area equal in size to roughly half of South America will be needed to feed this larger population" (*Kretschmer 07/22/2011*). In order to supply the population of 10 billion people the agriculture space will have to be enlarged and lands will have to be given up so that there will not be famine across the world. With vertical farming, simple high buildings can replace those crops. "1 indoor acre is equivalent to 4-6 outdoor acres or more, depending upon the crop" ("The vertical farm"1). This demonstrates that if the project will be achieved, the space needed for those crops can be saved and used for other important issues such as planting new trees in order to keep Earth's atmosphere balanced and protect it from further menaces.

Another positive aspect of vertical farming is that black and gray water (waste water) will be recycled into potable water for the crops of food. Currently, agriculture uses about 70% of freshwater available on Earth (Despommier 162). New York city among other big cities, is known for wasting this extreme amount of black and gray water everyday. Vertical farming will use the aid of plants in order to recycle this water. This process is called evapotranspiration. The plants that will take in this water through their tissue and will then release purified H20 into an enclosed room where this evaporation of the clean water will be used in order to water the crops inside of the vertical farm. Therefore tons of unused water will be reused in order to grow those crops. It is very ecologic to do so since it will decrease the large amount of freshwater pumping from Earth, so that this water can be used for other purposes.

Vertical farming is worth project because it will protect the food from different types of weather hazards. Every year crops are destroyed by natural disasters such as floods, hurricanes and the change in temperature ("The vertical farm" 1). Vertical farming will offer this protection to the food grown since it is indoors and everything is monitored. No weather hazard will be able to ruin the crops and therefore loose large amounts of necessary food. Another threatening factor is global warming. Earth's climate is constantly changing and global warming is occurring and is expected to increase even more in the next years. This will put at risk the crops since the plants need to be under certain circumstances in order to grow well. Vertical farming will keep the crops away from harms that are related to weather.

One issue with vertical farming is that it is very expensive. "Despommier estimates that it would cost $20 million to $30 million to make a prototype of a vertical farm, but hundreds of millions to build one of the 30 story towers that he suggest could feed 50,000 people" (Venkataraman July 15, 2008). This project will indeed cost a lot but will be worthwhile. If one vertical farm building can fee 50,000 then it has a great effect. It will not only help with decreasing transportation, crop acres used, water being pumped from earth, and also crop

Comment [DM1]: Formal tone is established WHST.9-10.1.d

Comment [DM2]: Student establishes the context for essay by explaining what vertical farming is. WHST.9-10.1

Comment [DM3]: A clear, precise claim is present with reference to the reasons and evidence that will be used to support it. WHST.9-10.1.a&b

Comment [DM4]: Claim is developed and evidence provided. WHST.9-10.1.b

Comment [DM5]: Establishes relationship between claim and reasons. WHST.9-10.1.c

Comment [DM6]: Claim is developed and evidence provided WHST.9-10.1.b

Comment [DM7]: Evidence drawn from texts (should be cited). WHST.9-10.9

Comment [DM8]: Claim is developed and evidence provided. WHST.9-10.1.b

Comment [DM9]: Establishes relationship between claim and counterclaim. WHST.9-10.1.c

Comment [DM10]: Student presents a counterclaim. Counterclaim is not fairly developed. WHST.9-10.1.b

destructions, but it will also help increase the amount of oxygen emitted into the atmosphere. If vertical farm are place din the middle of large cities, the plants inside of it will use photosynthesis in order to take in the CO2 emitted by all human activities and will release instead oxygen. Also since the crops will be replaced by those vertical farm, there could be projects of using those lands in order to plant new trees and plants so that deforestation will not be such a big issue anymore on Earth. I believe that the investment is valuable and will help deal with the troubles that threaten this planet in the next few decades. There should be a small tryout to see if those vertical farms work efficiently so that further conclusions can be made instead of immediately dismissing this idea.

Comment [DM11]: Concluding statement. WHST.9-10.1e

Student A Summary: Level 3 (Meets Standards)

The writer introduces a precise claim and frames the arguments by establishing the significance of the claim. The arguments each use logical reasoning and relevant evidence gained from the texts. The writer addresses a counterclaim, though not thoroughly and fairly. There is a clear conclusion that summarizes and supports the argument. The writing is clear and coherent and the development, organization, and style are appropriate to the task, purpose, and audience. Additionally, this student did not provide a works cited page.

Next Steps for Student A
Next steps for this student could be to support them in developing counterclaims fairly by having them practice supplying data and evidence that support a counterclaim. Present student with mentor texts to highlight how authors of arguments present and develop counterclaims. Provide student with a T-chart graphic organizer that assists students in taking notes while reading so that they can keep track of counterclaims/supporting evidence vs. claims/supporting evidence. The chart should have a column for page numbers so students can easily find quotations when writing their essays. When providing feedback to the student on their writing, the teacher could underline counterclaims that are identified by the student and then ask the student to insert one or two sentences that explain the data and/or evidence that supports the counterclaim.

Grade 9-10 Literacy in Science: Vertical Farming
Annotated Student Work

Student B: Level 3

Growing Up(wards): Implications of Vertical Farming on the Future of Sustainable Food

In the United States, the country's food production operates in a nation-wide industrial system based on specialized, subsidized farms in rural areas of Middle America. Because large percentages of the national population live in large urban areas quite a distance away from these farms, it takes a great deal of energy to preserve and transport food in order to feed these millions of people. As the national (and global) population continues to expand steadily, it is becoming increasingly clear that our current industrialized food system is very unsustainable, and some are searching for alternatives. One proposal, from Columbia professor Dr. Dickson Despommier, Ph.D., is the idea of vertical farming in urban areas. After much research and conceptual development, vertical farming has emerged as a feasible, practical, and sustainable idea that would greatly benefit the people of New York City by providing them with fresh, healthy, and accessible food.

Comment [DM12]: Formal style established. WHST.9-10.1d

Vertical farming is an alternative method for growing and harvesting food. It's exactly what it sounds like: farming vertically, as in tall buildings, as opposed to horizontally, as in wide expanses of land. Vertical farming, due to the fact that it is farming in urban buildings, would be carried out using indoor lighting. Plants cannot grow in the dark—light is required to begin the process of photosynthesis, which occurs in two stages. In the first stage, called light reactions, light is used to decompose water and form two energy storing molecules, ATP and NADPH. These molecules are then used as energy sources for the second stage, called the dark reactions or the Calvin cycle, but without light to begin with, the whole process would not occur. In some cases, indoor lighting can work better than natural light because in the case, the wavelength(s) of the light that the plants are exposed to is more selective. The reason plants are green is because a pigment within plant cells called chlorophyll reflects green light, and absorbs mostly red and blue light. To maximize plant growth by maximizing photosynthesis processes, vertical farms can exclusively use a combination of red and blue light. The plants would likely grow under the very bright but low energy Light-Emitting Diodes, or LEDs (Max). Another aspect of vertical farms is hydroponics, which eliminates the need for soil. Hydroponics is exposing roots to water that is rich in mineral essential for plant growth. Soil itself is simply a reservoir for holding water and minerals for the plant, and taking it away has no effect on plant growth, at least not a negative one. In vertical farms, temperature is kept constant as well, which translates into constant crop growth and harvest (Max). Indoor lighting, hydroponics, and climate control are the basis of vertical farming, combined with the fact that the plants would be grown and harvested in a large building, with each floor specific to a different crop.

Comment [DM13]: Clear claim, however reasons are not supplied in the introduction paragraph—lacks connection between claim and reasons. WHST.9-10.1a

Comment [DM14]: Develops claim by supplying data and evidence. WHST.9-10.1b

Comment [DM15]: While no citation is given, there is evidence from research and experimentation is used to help form an argument. WHST.9-10.9

Vertical farming has many advantages over traditional farms; the foremost advantage being the proximity of the food source to the consumer. The locality decreases costs of transportation, and the environmental implications of it, by eliminating long-distance transportation altogether. It also creates jobs in the urban areas surrounding the vertical farms, which need to be constructed, but also kept running efficiently. The hydroponics method used in vertical farms recycles water constantly, decreasing the amount of water needed for such an initiative, which contrasts the fact that farm irrigation "accounts for about a third of water use and is currently the largest use of fresh water in the United States" ("Water use.." 2011), though other estimates are higher. The water yield for vertical farming would not even compare to the amount used in agricultural irrigation, allowing the fresh water to be redirected elsewhere. Another huge benefit of vertical farming is that it allows massive ecosystem restoration in places where it has been destroyed to make room for farmland. In Despommier's book, titled *The Vertical Farm* (2010), he explains that "[l]arge-scale environmental restoration is high on everyone's list of things we wish we could do, but most perceive it as an unrealistic goal due to the amount of land we now need to farm, with more land needed in the future as the human population increases" (154). With farming happening in densely populated urban areas, built over empty lots or other unused spaces in the city, the ecological footprint left by agricultural demands would decrease significantly. The list of benefits continues, including a 100% decrease in weather-related crop

Comment [DM16]: Develops claim by supplying data and evidence. WHST.9-10.1.b

Comment [DM17]: Develops claim by supplying data and evidence. WHST.9-10.1.b

Comment [DM18]: Evidence from informational text. WHST.9-10.9

failure, complete organic farming without the use of herbicides/pesticides/fertilizers, and finally—this may be a stretch—due to the fact that vertical farming requires very little land and resources to work efficiently, it could, in other regions of the world, reduce the incidence of armed conflicts regarding natural resources, such as water and land ("Advantages..").

Of course, every solution has drawbacks. The main one in the case for vertical farming is that implementing these structures and their accompanying sustainable food programs would initially be very expensive, and would have to be factored into the city's budget at the time of construction, likely funded by taxpayers in the city/area of construction. However, these funds (which may come with a tax increase) would be balanced by a dramatic decrease in the amount of money people will have to spend on their food. The decrease, as stated before, comes from a lack of transportation costs, and a low demand for resources to grow the food.

There are several stakeholders in this situation. The biggest one is consumers, who are also taxpayers. These people may face an increase in their city tax payments to cover the cost of the vertical farms, but in return they get a low-cost, sustainable source of food. In addition, vertical farms central to urban areas would provide a source of jobs to residents, not only in construction, but in running and maintaining the farms as well. Related to that are the rural stakeholders, the people who maintain the current source of America's food. While they will lose business and eventually their jobs as industrial farmers, the reality is that they are supporting an unsustainable industry that is having adverse effects on the environment, considering its massive consumption of the country's water and need for long-distance transportation, not to mention the overuse of herbicides and pesticides needed to maintain outdoor farming. With the population growing and the cities becoming the epicenters of the country, what is needed is a massive upheaval and rearrangement of how we go about growing and distributing our food. The current industrial food system has proved that it is no longer a working option, while the prospect of vertical farming provides possible solutions such as efficient, year-round crop growth, more jobs for city residents, and local, urban centers that do not require traversing long distances in fossil-fuel consuming trucks, and others forms of transportation, just to feed the people of America.

Comment [DM19]: Evidence from informational text. WHST.9-10.9

Comment [DM20]: Clarifies relationship between claim and counterclaim. WHST.9-10.1.c

Comment [DM21]: Develops counterclaim by supplying data and evidence. WHST.9-10.1.a&b

Comment [DM22]: Discussing the stakeholders helps to support the argument, but the way the discussion is organized seems somewhat disjointed. WHST.9-10.1b

Comment [DM23]: Concluding statement or section that follows from or supports the argument presented. WHST.9-10.1.e

References

Despommier, D. (2010). *The vertical farm*.

Max, A. (2011, April 11). Future farm: A sunless, rainless room indoors. *USA Today*, Retrieved from http://www.usatoday.com/money/smallbusiness/2011-04-16-indoor-farming.htm

Advantages of vertical farming. (n.d.). Retrieved from http://www.verticalfarm.com/more

Water use in the United States. (2011, January 26). Retrieved from http://nationalatlas.gov/articles/water/a_wateruse.html

Student B Summary: Level 3 (Meets Standards)

The writer introduces a precise claim and frames the arguments by establishing the significance of the claim. The arguments each use logical reasoning and relevant evidence gained from the text. However, the claim could be improved by including more references to the reasons and evidence that will be used to support it. The writer addresses counterclaims and challenges them in order to further support the claim. There is a clear conclusion that summarizes and enhances the argument. The student established a formal tone, and the organizational structure is appropriate to task, purpose, and audience.

Next Steps for Student B

Provide student with mentor texts to demonstrate how an author presents a claim and supports the claim with specific data and relevant evidence from other informational texts. Also, Student B presented a counterclaim, but it was not developed fairly. Student could benefit from further instruction around developing counterclaims. For example, the teacher could provide student with a T-chart graphic organizer that assists him/her in taking notes while reading so that he/she can keep track of counterclaims/supporting evidence vs. claims/supporting evidence. The chart should have a column for page numbers so students can easily find quotations when writing their essays. When providing feedback to the student on their writing, the teacher could underline counterclaims that are identified by the student and then ask the student to insert one or two sentences that explain the data and/or evidence that supports the counterclaim.

Grade 9-10 Literacy in Science: Vertical Farming
Annotated Student Work

Student C: Level 2

Vertical Farming Policy Brief

I believe that vertical farming will be beneficial to our society as a new way to grow and harvest our crops. It's impact will be valuable to people of New York City. Vertical farming is when you take a tall building, such as a skyscraper, etc. and use each level as a controlled environment for growing crops, such as corn, potatoes, tomatoes, etc. Plant growth is a process in which the cells in the plans cells obtain nutrients and enzymes through a process called photosynthesis. The enzymes are, for example, light which helps speed up the process of plant growth. Photosynthesis also gets the plant nutrients and converts light to glucose for the plant. The indoor conditions to grow the plant will be a controlled environment with artificial lights.

The benefits will be since our plants are in a controlled environment, we can control pests that may contaminate or get in the way of the crops growing. We can also cut down on how much the food costs and how much pollution goes into the air because the crops don't need to travel as far to get to customers that buy them. Also, the building could water the crops using recycled water and then reuse the water. Agriculture uses lots of fresh water anyway, so if we can reduce the amount that is used then there will be more available for people to drink.

However, drawbacks would be since our crops would probably be genetically modified then some people might have things against the genetically engineered crops. If people don't buy the crops then the vertical farms could go bankrupt. Both the farmers and the people buying the crops are important stakeholders in this issue. Another thing that would be standing in the way would be the cost. Although it would cost a lot more than traditional farming, some people won't mind because of all of the benefits such as the food being organic and the safety from contamination. It would be worth the extra money spent.

Comment [DM24]: The tone is informal. WHST.9-10.1.d

Comment [DM25]: A basic claim is introduced but not developed. WHST.9-10.1a&b

Comment [DM26]: The student attempts to connect the claim to reasons and evidence. WHST.9-10.1b

Comment [DM27]: Support is present for the arguments, but specific data, references to text, and/or details are missing. WHST.9-10.1.b

Comment [DM28]: Attempts to establish counterclaim, but not does not tie genetically modified food to vertical farming. WHST.9-10.1.c

Comment [DM29]: The counterclaim is present and works to support the argument, but it is not developed fairly. WHST.9-10.1.b

Comment [DM30]: Brief concluding statement. WHST.9-10.1e

Student C Summary: Level 2 (Approaches Standards)
The writer introduces a basic claim and explains what vertical farming is but does not explain why it may be necessary. The arguments use logical reasoning and evidence gained from the text, but the texts were not referenced which would support and further the argument. The writer addresses a counterclaim and briefly challenges it. The concluding statement is brief and does not summarize the reasons presented in the essay. There are a few grammatical errors and the tone is not formal or objective.

Next Steps for Student C
More careful reading of sources in order to gather evidence is required. Creating a chart (shown below) could be helpful for organizing text-based (or other forms of) evidence that is acquired from research. The writer should be reminded that a conclusion serves to recapitulate the arguments posed and ultimately strengthen the claim. Mentor texts can be used to effectively model for the student ways in which authors write conclusions.

My Current Argument	Evidence that I Find	How It Supports My Current Argument

GRADE 9-10 LITERACY IN SCIENCE:

VERTICAL FARMING

INSTRUCTIONAL SUPPORTS

The instructional supports on the following pages include a unit outline with formative assessments and suggested learning activities. Teachers may use this unit outline as it is described, integrate parts of it into a currently existing curriculum unit, or use it as a model or checklist for a currently existing unit on a different topic.

Unit Outline

INTRODUCTION: This unit outline provides an example of how to integrate performance tasks into a unit. *Teachers may (a) use this unit outline as it is described below; (b) integrate parts of it into a currently existing curriculum unit; or (c) use it as a model or checklist for a currently existing unit on a different topic. The length of the unit includes suggested time spent on the classroom instruction of lessons and administration of assessments. Please note that this framework does not include individual lessons.*

Grade 9-10 Literacy in Science: Photosynthesis and Vertical Farming

UNIT TOPIC:

This unit on photosynthesis and vertical farming will teach students about the role of photosynthesis in creating much of the food needed for life on Earth. In addition, students will come to realize how changing our approach to how we grow our food can change the impact we have on the environment around us. This unit on metabolism takes place after students have background knowledge in cell process, homeostasis, and ecology. It is aligned with New York State Living Environment Science Standard 4, Key Idea 5: Organisms maintain a dynamic equilibrium that sustains life. Using their knowledge about the role of photosynthesis in creating food, students will do guided research on vertical farming, culminating in an argument task in which they argue whether vertical farming is a viable industry for New York City.

COMMON CORE CONTENT STANDARDS:

Standards Assessed by the Task:

WHST.9-10.1 Write arguments focused on *discipline-specific content*.

a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.

c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

e. Provide a concluding statement or section that follows from or supports the argument presented.

Standards Addressed in the Unit:

WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

BIG IDEAS/ENDURING UNDERSTANDINGS:	**ESSENTIAL QUESTIONS:**
➢ Plants use light to synthesize their own food and humans, along with other animals, benefit from this immeasurably. ➢ Humans have always had to and need to continue to develop ways to deal with challenges presented by the environment and as a result of their own actions. ➢ Knowledge of science and biology can be used to develop policies that benefit as many people and groups as possible. ➢ Photosynthesis requires light (and actually certain wavelengths of light) in order produce food for both plants and the animals that consume them.	➢ Where does our food come from? ➢ What factors influence photosynthesis? ➢ How can knowledge of science influence public policy?
CONTENT: ➢ Photosynthesis: reactants, products, energy sources, associated organelles ➢ Light and electromagnetic radiation ➢ The connections between light and photosynthesis ➢ Vertical farming: definition, potential advantages and costs	**SKILLS:** ➢ Argument Writing ➢ Crafting a claim ➢ Supporting a claim with evidence ➢ Addressing counterclaims ➢ Obtaining information from multiple sources and properly acknowledging them (using APA format) ➢ Experimental Design – secondary skills ➢ Generating a testable hypothesis ➢ Analyzing data ➢ Drawing specific conclusions

VOCABULARY/KEY TERMS:

➢ Reaction, catalyst, enzyme, photosynthesis, respiration, glucose, light, wavelength, photosystems I and II, photon, carbon dioxide, vertical farming, carbon footprint, energy, frequency, oxygen, gray water

ASSESSMENT EVIDENCE AND ACTIVITIES:
INITIAL ASSESSMENT :

Summary – Students read about the phenomenon of ocean acidification, write a detailed summary of specific aspects of the issue, and then make a claim about the solution to ocean acidification that is supported with reasons and evidence.

FORMATIVE ASSESSMENT:

Summary – Students read about the amount of land used for farming worldwide, write a detailed summary of specific aspects of the issue, and then make a claim about the solution to land use for farming that is supported with reasons and evidence. They will also cite sources in a bibliography that uses APA format.

FINAL PERFORMANCE TASK:

Students will write a policy brief for a local congresswoman in order to inform her about vertical farming and its viability in New York City. A clear claim needs to be crafted and then arguments with evidence and reasoning will be used to support and further that claim as well a counterclaim.

LEARNING PLAN & ACTIVITIES:

For ideas on how to plan for and teach this unit, see the Suggested Learning Plan that follows this Unit Plan. Please note that this Learning Plan does not include detailed lesson plans but is more a suggested arc of lessons that would support student success with the culminating task. Teachers will need to do additional planning before teaching this unit.

RESOURCES:

Final Assessment:

Despommier, Dickson. *The Vertical Farm: Feeding the World in the 21st Century.* New York: Picador, 2011.

Kretschmer, Fabian, and Malta E. Kollenberg. "Can Urban Agriculture Feed a Hungry World?" *Der Spiegel*, July 22, 2011

http://www.spiegel.de/international/zeitgeist/0,1518,775754,00.html
Max, Arthur. "Future Farm: A Sunless, Rainless Room Indoors." AP, April 16, 2011.

http://www.usatoday.com/money/smallbusiness/2011-04-16-indoor-farming.htm

Venkataraman, Bina. "Country, the City Version: Farms in the Sky Gain New Interest." *New York Times*, July 15, 2008.Retrieved from http://www.nytimes.com/2008/07/15/science/15farm.html

"Common Vertical Farming Disadvantages." A Sustainable City. Retrieved from
http://asustainablecity.com/common-vertical-farming-disadvantages/

Initial assessment:
"Ocean Acidification," National Geographic.
http://ocean.nationalgeographic.com/ocean/critical-issues-ocean-acidification/

Formative assessment:
Owen, James. "Farming Claims Almost Half Earth's Land, New Maps Show." National Geographic News, December 9, 2005 http://news.nationalgeographic.com/news/2005/12/1209_051209_crops_map.html

Other resources:
El Nasser, Haya. "World Population Hits 7 Billion." *USA Today*, October 30, 2011.

http://www.usatoday.com/news/world/story/2011-10-30/world-population-hits-seven-billion/51007670/1

Website for Dickson Despommier's book *The Vertical Farm*
www.verticalfarm.com

BIG IDEAS spotlight on vertical farming: http://www.youtube.com/watch?v=1clRcxZS52s

Overview of vertical farming: http://www.youtube.com/watch?v=U8O_St95tV8

Discovery Channel on vertical farming: http://www.youtube.com/watch?v=Scs2SIeIkkM&feature=relmfu

Materials for Labs/Demonstrations:

Effects of Carbonic Acid Demonstration:
Water
Baking soda
BTB (bromthymol blue)
Straw
Cups/beakers

Photosynthesis Demonstrations:
Elodea sprigs
Water
Beakers
60 Watt light bulb

Do Plants Pass Gas Experiment:
Elodea sprigs (2–4 per table, can be cut in half)
BTB (bromthymol blue)
Water
Cups/beakers
Pipettes
Test tubes
Fluorescent lights
Colored gels (can be obtained a photography store or a party supply store)

Suggested Learning Plan

Please note that this Learning Plan does not include detailed lesson plans but is more a suggested arc of lessons that would support student success with the culminating task. Teachers will need to do additional planning before teaching this unit.

Lesson 1: Introducing photosynthesis
Mini-lecture on photosynthesis and plant cell anatomy

Vocabulary: chloroplast, chlorophyll, thylakoid, grana, stroma, cell wall, cell membrane, vacuole, nucleus, oxygen

Demonstration
Teacher sets up demonstration of *Elodea* carrying out photosynthesis.

- make a sodium bicarbonate solution by adding 1 teaspoon of baking soda to 24 oz. of water
- place an *Elodea* spring in the test tube and fill the tube to the top with the sodium bicarbonate solution
- cover the mouth of the test tube with your thumb, invert the test tube, and then (without letting go) place the test tube back into the beaker with the remaining sodium bicarbonate solution
- place tube and beaker under a 60 watt light bulb

Students observe and record the amount of air (oxygen) in the test tube.

Additional Support Strategies: For students that need help understanding the concept of photosynthesis and plant cell parts, consider the following resources:
Note-taking: Provide students with a graphic organizer that can assist in recording the parts of a plant cell or for recording observations and making inferences about the demonstration (depending on student need).
Video: Video clips demonstrating the parts of a plant cell and the process of photosynthesis are widely available on the internet (ex., BrainPOP.com). These videos can assist students with visual conceptualization.

Lesson 2: Introducing the relationship between the color of light and photosynthesis
From previous lesson: Students observe and record the amount of air (oxygen) in the test tube, which should be some (proving that photosynthesis produces a gas, which is oxygen).

Mini-lecture on how chlorophyll absorbs different wavelengths of light.

Vocabulary: light, wavelength, chlorophyll

Formative Assessment 1: Photosynthesis Check-In
1. Describe what happens during photosynthesis. Use vocabulary and be specific.
2. What would most likely happen to the rate of photosynthesis in Elodea sprigs increased from 60 watts to 100 watts? Explain your answer.

Additional Support Strategies: For students that need help understanding the concept of how chlorophyll absorbs different wavelengths of light, consider the following resources:
Notetaker: Provide students with a graphic organizer that includes diagrams of electromagnetic spectrum and the absorbance of different wavelengths of light by chlorophyll or for recording observations and making inferences about the demonstration (depending on student need).
Video: Video clips demonstrating the parts of a plant cell and the process of photosynthesis are widely available on the internet (ex. BrainPOP.com). These videos can assist students in conceptualization.

Lesson 3: Investigating the relationship between the color of light and photosynthesis

Students make hypotheses about how the color/wavelength of light will affect photosynthesis in *Elodea* sprigs (based on previous mini-lecture about chlorophyll and how it absorbs different colors of light) and plan an experiment to test this hypothesis.

Do Plants Pass Gas? (Part 1)

Question: How does the wavelength of light affect photosynthesis?

Introduction
Our upcoming experiment is going to investigate how factors in the environment can affect how plants are able to produce and consume gases. We will be working with *Elodea* plants, which grow in fresh water and are often used in aquariums. Photosynthesis is an important reaction, both to plants and the animals that depend on them.

As discussed, photosynthesis uses carbon dioxide, light, and water to produce oxygen and glucose. The easiest chemical to measure in this case is carbon dioxide. We can again use the indicator **BTB (bromthymol blue)** to detect and measure if carbon dioxide is being removed from the water and therefore being used for photosynthesis. Carbon dioxide causes the normally blue BTB to turn green and then yellow if enough CO_2 is present.

Name: _____ Classwork # _____

Make sure you have a **testable question** that is
- answered through an experiment, not research.
- practical and specific.
- asked with a "How?" instead of "Why?"

WH	S

Write your experimental question in the space below.

Make sure you have a **testable** hypothesis (or hypotheses) that is

- measurable - specific - clear

Write your hypothesis or hypotheses in the space below.

The removal of carbon dioxide should cause the BTB to return to its blue color. A bluer color is the result of the presence of less carbon dioxide. Less carbon dioxide is the result of it being used as a reactant in photosynthesis. A yellow color would mean that more carbon dioxide was produced and that photosynthesis probably did not occur. Think about what reaction would create more carbon dioxide and a yellow color in the BTB.

What reaction would cause BTB to turn yellow?

_____

What reaction would cause BTB to turn blue?

_____

Elodea can be kept in a sealed tube with water and BTB in order to show how photosynthesis and respiration change the amounts of CO_2 in a solution.

Your group will develop a question to investigate and a hypothesis to test in order to answer that question. The question should focus on how photosynthesis is affected by the color of light (ex. red, green, blue, yellow, or white).

After you develop your question, you and your group will develop hypotheses to test. Make sure that your hypotheses are clear, specific and measurable. For example, how would you ***measure*** that something is going to cause the plant to do more or less photosynthesis?

Model Hypotheses for "Do Plants Pass Gas?"

Level 1 (overly simplistic)	If the plant is placed under blue light, then the water will turn blue.
Level 2 (basic)	If the plant is placed under blue light, then the BTB will turn blue because there is less CO_2.
Level 3 (detailed)	If the *Elodea* plant is placed under blue light, then the BTB will turn blue because there is less CO_2 as a result of more photosynthesis.
Level 4 (thorough)	If the *Elodea* plant is placed under blue light, then the BTB will turn more blue because there is less CO_2 as a result of more photosynthesis. Chlorophyll absorbs blue wavelengths of light more than other wavelengths of light such as green or yellow.

Additional Support Strategies: For students that need help developing and crafting a hypothesis, consider supplying sentence starters. For example, the following starter could be used:
If _____ happens, then _____ will be observed because _____.
In addition, consider providing a graphic organizer that can assist students in recording their observations for later use in developing a hypothesis. For example:

If my water turns	it means	which means
BLUE	Less CO_2	Photosynthesis occurred

Lesson 3a : Students set up experiment and make observations

Do Plants Pass Gas? Part 2: Procedure

1. Fill your plastic cup with water.
2. Add 15 drops of bromthymol blue (BTB) to the water in the cup. Let the BTB diffuse and note the color.
3. Using a straw, exhale into the cup for a second or two at a time until the BTB turns green or yellow.
4. Place an *Elodea* sprig into each of your test tubes.
5. Fill each test tube with the BTB/water mixture to the same level (enough to submerge the *Elodea* sprig).
6. Place a cap onto each tube and seal it by twisting it shut.
7. Record the color of the liquid inside each test tube. Observing it against a white background (such as the back of this handout) could be helpful. Feel free to take a picture as well.
8. Label each test tube with a piece of masking tape containing your initials, class, and color of light. NOTE: It is not a good idea to allow the tape to obscure the clear side of the tube.
9. Place each test tube in the light bank under the desired color.
10. Determine a time to check on the tubes later on today.
11. Later on, when you check on the tubes, remember that the BTB is difficult to see in such a small, thin tube. Try pouring the contents of each tube into an empty, clear cup and then view it against a white background and it may be easier to see any changes.

Lesson 3b: Students finish making observations and then draw conclusions about the effect of the color of light on photosynthesis in *Elodea* sprigs

Students support their conclusions with clear, specific references to their observations and teacher introduces the idea of a claim as an opinion or a proposed relationship that can be supported (by reasoning and evidence). Teacher models using reasons and evidence to support conclusions.

Formative Assessment 2: Do Plants Pass Gas?

Data Analysis and Recommendations
1. Using the data you collected, make a statement connecting your hypothesis to the data. Was the hypothesis supported or not supported by the results of your experiment?

2. Provide your best explanation for the data that you obtained. In other words, what happened in the experiment to give you the data that you recorded?
a. For example, what happened to the different *Elodea* samples? Why did each sample look the way that it did? Be sure to use appropriate vocabulary in your answer when explaining what happened to the *Elodea* plants.
b. Be sure that you answer the experimental question that you were investigating.

3. What conclusions or recommendations can you make based on your work?
a. What recommendations or advice can you offer for people who want to grow plants indoors?
b. For example, what color(s) of light and/or intensities of light would be beneficial for growing plants quickly? Explain.

Task Lesson 1
Students watch demonstration of carbonic acid formation in water (by exhaling through a straw into water) and measuring the change in pH. Students make observations and inferences.

Students read about the phenomenon of ocean acidification and discuss (in partnerships, groups, as a class) how the issue of ocean acidification is related to

1. The carbonic acid formation demonstration
2. Human actions
3. Photosynthesis

"Ocean Acidification," National Geographic. Retrieved from http://ocean.nationalgeographic.com/ocean/critical-issues-ocean-acidification/

Additional Support Strategies: For students that need support independently reading informational texts, consider providing a graphic organizer such as the following:

How does the reading connect to the . . .		
Demonstration?	Human actions?	Photosynthesis?

For students that need support with recording observations and making inferences, consider providing a graphic organizer that assists students in taking notes as they carry out the experiment.

Task Lesson 2: Initial Assessment
Students will complete the Initial Assessment. Teacher can collect and review Initial Assessment or have students assess their own claims according to the Ocean Acidification rubric. **See "Ocean Acidification Rubric."**

Student-facing version:
Read the document about ocean acidification
(http://ocean.nationalgeographic.com/ocean/critical-issues-ocean-acidification/
Take notes about important information related to ocean acidification.

1. Summarize the problem being described in the article. Think about and include these aspects of the issue:
    a. What is happening.
    b. Where in particular it is happening.
    c. When it happened/is happening.
    d. Why it is happening.

3. Make a claim about ocean acidification and why it is a problem. State how the problem can be solved. Support your claim with reasons and evidence from the text.

Ocean Acidification Initial Assessment Rubric

Level	**Criteria**
1 (vague)	- claim uses common language - proposed solution is unclear - Ex. Ocean acidification needs to be stopped.
2 (basic)	- claim uses some vocabulary from class/reading - proposed solution is present - Ex. Ocean acidification is bad for aquatic organisms so it needs to be stopped by putting less carbon dioxide into the atmosphere.
3 (precise)	- claim uses vocabulary from class/reading - proposed solution is clear - Ex. Citizens need to work on reducing their carbon dioxide emissions because it leads to ocean acidification which damages marine organisms.
4 (knowledgeable)	- claim uses vocabulary from class/reading - proposed solution is clear - language is persuasive - Ex. All citizens need to work on reducing their carbon dioxide emissions because it leads to ocean acidification which irreparably damages marine organisms.

Task Lesson 3
Students read about Earth's increasing population
http://www.usatoday.com/news/world/story/2011-10-30/world-population-hits-seven-billion/51007670/1

Students discuss (in partnerships, groups, as a class) how the issue of increasing population (and overpopulation) is related to

1. human actions,
2. photosynthesis, and
3. ocean acidification.

Literacy Focus
Teacher uses text as mentor to demonstrate how author supports claim (*sustainable infrastructure is needed*) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

Additional Support Strategies: To support students in organizing their ideas as they read complex informational text, the following graphic organizer can be used.

How does the author support his claim that sustainable infrastructure is needed?		
Reasons	Data	Evidence/solution
Increase in the number of people living in urban cities will strain infrastructure	The UN estimates 69% of population will live in urban cities by 2050.	Siemans installed energy-efficient traffic lights in Houston, Texas

Task Lesson 4
Students read about the phenomenon of agriculture and its effects on the environments
http://news.nationalgeographic.com/news/2005/12/1209_051209_crops_map.html

Students discuss (in partnerships, groups, as a class) how the issue of agriculture is related to

1. the previous demonstration,
2. human actions, and
3. photosynthesis.

Literacy Focus
Mini-lecture on APA format of bibliography (why include a bibliography, why use APA, and how to construct it)

Formative Assessment
Student-facing version:

After reading the *National Geographic News'* "Farming Claims Almost Half Earth's Land, New Maps Show," answer the following questions.

1. In 3–5 sentences summarize the problem being described in the article. Think about and include these aspects of the issue:
    a. what is happening.
    b. where in particular it is happening.
    c. when it happened/is happening.
    d. why it is happening.
2. Identify the stakeholders (people who care about any aspect of the problem) and describe their views on the problem/its causes.
3. Describe any solutions being proposed.
4. Which solution do you think is best? Support your claim with your reasoning and any evidence from the text.
5. Construct a bibliography using APA format.

Task Lesson 5

a. Students practice crafting a claim in response to the question, "Is agriculture bad for Earth?" Students then support this claim with reasoning and evidence previous lesson's article about agriculture. Students will also posit a counterclaim.

b. Students work with the following rubric (or rubrics) for supporting a claim with evidence (optional, and review forming a claim). **See "Supporting a Claim Rubric."**

Additional Support Strategies: To support students in organizing their ideas as they frame their claim/counterclaim, the following sentence starter can be used:

While some feel that modern agriculture is _____, there are others that think _____.

Supporting a Claim Rubric

Level	Criteria
1	- support for claim uses common language - support for claim is logical - support for claim refers to evidence but it is not clear
2	- claim uses some vocabulary from class/reading - support for claim is logical - support for claim refers to relevant evidence
3	- claim uses vocabulary from class/reading - support for claim is logical - support for claim explicitly refers to relevant evidence - counterclaim is present
4	- support for claim uses vocabulary from class/reading - support for claim is logical - support for claim explicitly refers to relevant evidence - counterclaim is present and works to support claim in the end - language is persuasive

Task Lesson 6–9

For the next several days, students read a variety of informational texts on the topic of vertical farming and discuss (in partnerships, groups, and as a class) how the issue of vertical farming is related to:

1. Photosynthesis,
2. The previous problems discussed (overpopulation, ocean acidification, agricultural issues), and
3. The experiments/demonstrations performed in class.

"The Basics of Vertical Farming" Analysis Questions

Students answer all of the following questions, referencing the texts as they support their reasons with accurate data and evidence:

1. What is vertical farming?
2. Why are some people advocating for vertical farms in urban areas? What are the benefits?
3. What are challenges or barriers that exist to seeing large-scale vertical farms in places like New York City?
4. What is your reaction to the articles about vertical farming and the idea of farming in a city (such as New York City)? Do you think that it is a good idea? Is it feasible or too impractical? Support your answer thoroughly.

Suggested Texts

Despommier, Dickson. *The Vertical Farm: Feeding the World in the 21st Century.* New York: Picador, 2011.

Kretschmer, Fabian, and Malta E. Kollenberg. "Can Urban Agriculture Feed a Hungry World?" *Der Spiegel*, July 22, 2011.
http://www.spiegel.de/international/zeitgeist/0,1518,775754,00.html

Max, Arthur. "Future Farm: A Sunless, Rainless Room Indoors." AP, April 16, 2011.
http://www.usatoday.com/money/smallbusiness/2011-04-16-indoor-farming.htm

Venkataraman, Bina. "Country, the City Version: Farms in the Sky Gain New Interest." *New York Times*, July 15, 2008.
http://www.nytimes.com/2008/07/15/science/15farm.html

Task Lesson 10: Administer Final Performance Task

Vertical Farming Policy Brief Final Task

Your tenure as an aide to United States Congresswoman Carolyn Maloney is going along smoothly (remember that she represents eastern Manhattan as well parts of Queens). You have the opportunity to offer her ideas for new laws and legislation.

While working, you come across several articles about vertical farming. Working for a representative in New York City, you realize that this is an issue of which your boss should be aware. Thus, your task is to write policy brief about whether or not New York City should begin to pursue vertical farming on at least some of the city's vacant lots (almost 9,000 acres worth in New York City).

Your policy brief should contain the following:

- **An overview of vertical farming and how it works.**
    - How does farming/plant growth actually work.
    - What reactions and/or structures are involved in plant growth?
    - Should plants be able to grow according to the principles of vertical farming?
    - Under what conditions will plants grow indoors?
- **Advantages and disadvantages of vertical farming.**
    - What are the benefits of vertical farming?
    - What are the drawbacks of vertical farming?
    - Who are the stakeholders in NYC affected by decisions about vertical farming?
    - What might their feelings be and how might they be affected?
    - If vertical farming is going to be carried out on a large scale, then can your knowledge of photosynthesis and the factors that affect it be useful for developing more efficient plans?
- **Your views on vertical farming**. State a precise claim, distinguish it from the opposing view (counterclaim) and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
    - Do you claim that it is a viable option worth pursuing in New York City? Or do you claim that it will not have any meaningful impact on the city? Or do you claim something different?
    - Develop your claim and the counterclaims fairly. Give evidence for both sides and note the strengths and weaknesses of each.
    - Be sure to use specific vocabulary (about photosynthesis, light, etc.) that you learned during the unit.
    - Provide a sense of closure that follows from and supports your views
    - Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- **You need to reference at least 2 or 3 texts on vertical farming that we read throughout the unit as you draw evidence to support your analysis, reflection, and research.**
- **Include an APA formatted bibliography.**
- **Remember you are writing to Congresswoman Maloney, so your writing should be developed, organized, and in a style that is appropriate to your audience.**

Additional Support Strategies: To support students in organizing their ideas as they frame their claim/counterclaim, the following graphic organizer can be used.

My claim about VF	
My 1st argument	
The evidence that supports that argument	
How the evidence connects to and supports my argument	
What is the counterclaim?	
What is the evidence to support the counterclaim?	
What are the ways in which the counterclaim may be flawed?	