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Air Pollution [Liberal Arts: Math and Science/Natural Science]

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ASSIGNMENT DESCRIPTION (ABSTRACT)

This assignment was designed for students in the pathways introductory chemistry class and the first year seminar and aligns with the Inquiry and Problem Solving core competency. In this context, there is a focus on “framing the issues” (identifies and/or addresses questions and problems), “evidence gathering” (assembles, reviews and synthesizes evidence from several diverse sources), “evidence” (analyze the data to address the questions posed) and “conclusions” (critical thinking, reflect on the outcomes, draw conclusions and generate new knowledge). There is also a Global Learning component based on comparing data collected locally with corresponding data from other locations or countries. The assignment includes the written communication ability with a focus on “Content Development and Organization,” as well as the clarity of the communication and its purpose. The overall aim of this assignment is to enhance students’ conceptual learning and understanding of key issues related to society as well as their course. This assignment was developed as part of a LaGuardia Global Learning mini-grant and CUNY Experiential Learning and Research in the Classroom mini-grants. The assignment will be scaffolded over about 3 weeks and is worth about 10% of the final grade.

To further increase the success of this assignment, instructors might want to consider the following:

- Use class discussions to focus on the relevance and importance of conceptual learning.
- In order to improve the data analysis aspect, incorporating class demonstrations of how to conduct the analysis and guide discussions about what the data means.
- Giving students more detailed rubrics with formal expectations of the requirements of the assignments, particularly in the written format
- Find ways to increase student participation in class discussions.

When this assignment has been utilized in previous semesters, students clearly displayed the capability to relate the co-curricular experiences in the data collection and its analysis to concepts and ideas covered during class. Evidence for this came from very dynamic and interactive class discussions based on air pollution as well as from the output of the written assignment, in which students were able to relate the nature, sources and chemical properties of the pollutants to their impact on the environment, health and society in general.

List the Program Goal(s) that this assignment targets	List the Student Learning Objective (s) that this assignment targets	List the Course Objectives(s) that this assignment targets	Write a short description of the pedagogy involved in executing this assignment
<p>Global Learning based on comparing pollutant levels around the LaGuardia campus with those in other locations or countries. It is also an IPS assignment, incorporating scientific literacy and thinking, as students need to analyze the data, interpret it and reflect on the outcomes.</p>	<p>Identify and apply fundamental chemical concepts and methods. Gather, analyze, and interpret data.</p>	<p>Explore the complex connections between chemistry and society. Apply chemical principles to real world issues, including ethical aspects. Gather, analyze, and interpret data.</p>	<p>Students collect and analyze the data, interpret the results in terms of pollution levels, safety and ethics and compare with EPA standard levels and with levels in other countries.</p> <p>Outside the classroom events will be organized for data collection. There will be class and group-based discussions focused on the data, its analysis and the connections to society.</p>

Air Pollution Assignment

Air Pollution Around the LaGuardia Campus

This assignment deals with the topic of air pollution and its relationship to human health. Data has been collected in Co-Curricular events involving the measurement of pollutant levels of NO₂, SO₂ and ozone at several locations around the LaGuardia campus.

The assignment requires you to write a report on the topic of air pollution based on an analysis of the data collected.

This is a **Scaffolded Assignment** with the following stages and timelines:

Stage 1 in Week 1: In-class lecture and class discussion focused on the concept of air pollution and its impact on the environment and society.

Stage 2 in Week 2: Co-curricular air pollution data collection event.

Stage 3 in Week 3: In-class group-based activities focused on analysis and interpretation of the collected data followed by class discussion of the outcomes of the analysis.

Stage 4 in Weeks 4 and 5: Homework assignment in which students produce a written report based on the questions and guidelines below.

Assignment Report

This is a written assignment, which should meet the dimensions of the Written Communication Ability. Please ensure that the content is well organized and logically structured and developed. Statements and conclusions should be supported by evidence derived from analyzing and interpreting the data. Clearly state whether what is written is factual or based on opinions and make sure to give the sources of any data or information used.

Remember to state the purpose of the written assignment and make sure that the writing is clear, flows smoothly and uses appropriate vocabulary for the scientific genre.

Please follow the guidelines below to complete your report.

Table 1.1 below shows data collected for the pollutants NO₂, SO₂ and ozone at various locations around the LaGuardia campus as well as the traffic patterns (number of vehicles) at these locations. This data was collected in the early afternoon on a sunny October day. Your class will collect new air pollution data.

Table 1.2 below shows the US Air Quality Standards.

In your report:

1. Please formulate an open-ended question concerning air pollution around LaGCC. This will be based on our lecture content and class discussions concerning air pollution. At the end of the assignment, you will be asked to provide a response to your question.
2. Please formulate and write down a hypothesis that will be explored by analyzing and interpreting the collected air pollution data.

Please include responses to the following questions:

3. What do we mean by pollution?
4. Why is air pollution important?
5. Which specific pollutants are of interest and why? There are more than the three pollutants analyzed here, so please discuss other ones (as well as the three analyzed here).
6. For this question, please see the pollution document distributed to you (on BlackBoard and via email) for more details. What are the effects on human health of:
 - (a) NO₂
 - (b) SO₂
 - (c) Ozone

The next set of questions ask you to analyze and interpret the data collected.

7. (a) Use the data collected by your class to create a Table in the same format as Table 1.1.

(b) To better visualize the data, draw a map of LaGCC and place the pollution concentrations on appropriate locations/points on the map.

8. When was your data collected? What was the time of day? What was the weather like during the data collection?

9. Compare the data you collected with the data in Table 1.1. Were there any differences in the data based on the time of day, weather and/or seasonal variations?

10. Were there any differences in the pollution data collected around LaGCC based on:

(a) Location

(b) Traffic patterns (number of vehicles)

11. Compare the data collected around LaGCC to the US Air Quality Standards for NO₂, SO₂ and ozone. Were any measurements approaching or above dangerous levels for:

(a) NO₂

(b) SO₂

(c) Ozone

12. Find data for one city outside of the US and compare our measured data with the data for that city.

(a) Which city did you choose?

(b) How do the levels for the three pollutants compare with the levels around the LaGuardia campus?

13. (a) What are your conclusions about the analysis of pollution data?

(b) Please provide a response to your initial open-ended question.

(c) Did the analysis and interpretation of the air pollution data address your initial hypothesis from Question 2?

(d) Were there any sources of error in the data collection process?

(e) How might cultural differences and economic, political and ethical issues influence efforts to combat air pollution and its environmental and health impacts both locally and globally? You can speculate here. This question is asking for your opinions about cultural, societal and ethical issues. There are absolutely no wrong answers here, so long as you thoughtfully address the question (which I am sure you will do!).

Table 1.1 Pollution Data Collected Around LaGuardia Campus.
The data was collected in the early afternoon on a sunny day in October

Location	Pollutant Level in ppm			Traffic: Number of vehicles
	NO ₂	SO ₂	Ozone	
Corner of Thomson and Van Dam	0.170	0.095	0.0075	80
Mid-block on Van Dam between Thomson and 47 th	0.181	0.095	0.0070	84
Corner of Van Dam and 47 th	0.102	0.070	0.0045	53
Mid-block on 47 th between Van Dam and 31 st	0.095	0.035	0.0025	48
Corner of 47 th and 31 st	0.098	0.020	0.0035	40
Mid-block on 31 st between 47 th and Thomson	0.080	0.005	0.0025	18
Corner of 31 st and Thomson	0.135	0.025	0.0045	66
Mid-block on Thomson between 31 st and Van Dam	0.087	0.075	0.0040	49

Table 1.2**U.S. National Ambient Air Quality Standards**

Pollutant	Standard (ppm)	Approximate Equivalent Concentration ($\mu\text{g}/\text{m}^3$)
<i>Carbon monoxide</i>		
8-hr average	9	10,000
1-hr average	35	40,000
<i>Nitrogen dioxide</i>		
Annual average	0.053	100
<i>Ozone</i>		
8-hr average	0.075	147
1-hr average	0.12	235
<i>Particulates*</i>		
PM ₁₀ , annual average	—	50
PM ₁₀ , 24-hr average	—	150
PM _{2.5} , annual average	—	15
PM _{2.5} , 24-hr average [†]	—	35
<i>Sulfur dioxide</i>		
Annual average	0.03	80
24-hr average	0.14	365
3-hr average	0.50	1,300