AQ-100 Unit 1 Lesson 1

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • NGSS SEP 6	Students will be able to... • Describe various types of air pollution, including solid and gas forms • Recognize harmful effects of air pollution • Define sensitive receptors

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Classroom discussion, lab observations	Post-lecture quiz

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Lead icebreaker activity and social contract creation	Participate in icebreaker activity and social contract creation
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Brainstorm lab safety rules Set up and lead introductory lab https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_altactivity1_apes_airpolllab.pdf Lead debrief of results	Contribute to lab safety rules brainstorm Participate in lab https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_altactivity1_apes_airpolllab.pdf Discuss results with lab partner, then share with the whole class
Communicate *Lesson content, direct instruction, guided practice*	Lead lecture, communicate expectation of post-lecture quiz	Take notes
Empower *Assess, students demonstrate understanding of lesson content*	Administer post lecture quiz https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_lecture-quiz_v2_tedl.pdf	Students complete post lecture quiz https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_lecture-quiz_v2_tedl.pdf

Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Distribute big picture homework https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_bigpicture-handout_v2_tedl.pdf	Big picture homework https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_bigpicture-handout_v2_tedl.pdf

MATERIALS: *What physical and digital materials are needed for your lesson?*

- Slides template
- 600 mL beakers, matches, foil, tiles, ethanol, cotton balls, cotton fabric, pieces of wood, nylon fabric, polyester fabric, plastic code 1, plastic code 2, plastic code 6 (Styrofoam), rubber bands, vinyl sheeting, rayon fabric, silk fabric, wool

AQ-100 Unit 1 Lesson 2

STANDARDS	**OBJECTIVES**
• CC Reading 11-12.9 • NGSS CC 2	Students will be able to... • Identify potential sources of air pollution • Explore cause and effect relationships between pollution generators and pollutants • Understand the proper application of various sensor types

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Classroom discussion, exit ticket	None

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Review social contract	Choose a social contract focus
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Lead debrief and take public notes on the results of the homework https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_bigpicture-handout_v2_tedl.pdf Direct exploration of live air quality maps	Share results from homework with partner and whole class https://www.teachengineering.org/content/cub_/lessons/cub_airquality/cub_airquality_lesson01_bigpicture-handout_v2_tedl.pdf Explore and notice trends in live air quality maps
Communicate *Lesson content, direct instruction, guided practice*	Instruct students on jigsaw reading purpose (learn source and health effects of different particulates) Present lecture	Students do jigsaw reading Students share learnings with peers in home groups Students take notes on the lecture
Empower *Assess, students demonstrate understanding of lesson content*	Support students in building basic DIY air sensors If time, test sensors using particulates from prior week's lab	Students begin construction on basic DIY air sensors (can continue into next week if needed) If time, test sensors using particulates from prior week's lab
Launch *Feedback, Self-Evaluation,*	Distribute exit ticket: What do you think is the most	Complete exit ticket

Affirmations, Connect lesson to life content	dangerous form of air pollution and why? What particulate sources would you like to sample?	

MATERIALS:

- Slides template
- Air sensor materials:

Equipment list for one device	Quantity
Arduino Uno	1
Grove Base shield for Arduino Uno	1
Grove Universal 4 pin buckled cable (20cm)	4
Grove RGB LED stick (10 lights)	2
Grove Laser PM2.5 air quality sensor for Arduino (HM3301)*	1
Grove VOC and eCO2 gas sensor for Arduino (SGP30)**	1
Lithium Ion Battery 3.7V 2000 mAh battery	1
LiPo Rider Plus Charger/Booster - 5V/2.4A USB Type C	1
USB cable type A to C	1
USB cable type A to B	1

AQ-100 Unit 1 Lesson 3

STANDARDS	**OBJECTIVES**
• CC Reading 11-12.9 • ESS.3 • NGSS SEP 4	Students will be able to... • Understand the fundamentals of atmospheric science • Explore the chemicals and human activity related to air pollution and atmospheric science. • Create simple graphs from atmospheric data

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Exit ticket, class discussions	Comparative Analysis Graphing

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Review social contract	Choose a social contract focus
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Set up particulates from lab materials for testing air sensors	Choose particulates for testing air sensors Assess sensor function according to Dyson lesson plan 02B worksheet
Communicate *Lesson content, direct instruction, guided practice*	Reading: https://www.ck12.org/book/ck-12-earth-science-concepts-for-high-school/section/14.2/ Direct student to the driving questions at the end of the reading	Reading: https://www.ck12.org/book/ck-12-earth-science-concepts-for-high-school/section/14.2/ Take notes on the reading and talk about the driving questions with a partner
Empower *Assess, students demonstrate understanding of lesson content*	Guiding students in working on the Graphing Worksheet: Graphing	Complete Graphing Worksheet: Graphing
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Distribute and collect exit ticket: Which part of the atmosphere is the most important? In other words, if a layer of the atmosphere disappeared tomorrow, which ones would we need to keep?	Complete exit ticket: Which part of the atmosphere is the most important? In other words, if a layer of the atmosphere disappeared tomorrow, which ones would we need to keep?

MATERIALS:

- Slides Template
- Air sensor particulates: candle, matches, aerosols, cornstarch powders
- Reading: https://www.ck12.org/book/ck-12-earth-science-concepts-for-high-school/section/14.2/
- Graphing Worksheet:Graphing

AQ-100 Unit 1 Lesson 4

STANDARDS	**OBJECTIVES**
• CC Reading 11-12.9 • ESS.3 • NGSS SEP 4	Students will be able to... • Explain the reasons behind the creation of the Clean Air Act, describe its main goals and provisions, and identify key milestones in its development. • Analyze data showing trends in air pollution levels before and after the implementation of the Clean Air Act • Discuss how the law has contributed to improved air quality and better health outcomes.

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Classroom discussion Exit Ticket	CER paragraph and data

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Review social contract	Choose a social contract focus
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Provide each small group with handouts containing historical photos illustrating the growing concern over air pollution during the mid-20th century. Instruct them to look through the materials together and highlight any issues, facts, or arguments that stand out to them. Have each group share one notable finding with the rest of the class.	Look through the materials together and highlight any issues, facts, or arguments that stand out to them. Share one notable finding with the rest of the class.
Communicate *Lesson content, direct instruction, guided practice*	Read pages 2-3 of the Plain English Guide to Clean Air Act together Split students into groups to read specific segments of the “Key Elements” (pages 4-13) Students share learning with each other	Read pages 2-3 of the Plain English Guide to Clean Air Act together Read specific segments of the “Key Elements” (pages 4-13) Share learning with each other

Empower *Assess, students demonstrate understanding of lesson content*	Direct students to graph air quality trends from EPA website Instruct students to use the data in a Claim, Evidence, Reasoning (CER) paragraph answering the question: “Is the Clean Air Act effective?”	Graphing air quality trends from EPA website Write a Claim, Evidence, Reasoning paragraph
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Affirmations	Affirmations to peers

MATERIALS:

- Slides Template
- Plain English Guide to the Clean Air Act: https://www.epa.gov/sites/default/files/2015-08/documents/peg.pdf
- Data tables: AQ-100 Unit 1 Lesson 4 EPA Data
- Historical documents and photos: AQ-100 Unit 1 Lesson 4 Photos

AQ-100 Unit 2 Lesson 1

STANDARDS	**OBJECTIVES**
• Understand the different types of particulate matter, recognize the health effects of particulate matter exposure, and evaluate the effectiveness of various particulate matter control technologies, Science and Engineering Practices (SEP 8). • Identify types and characteristics of particulate matter, Reading Standards for Informational Text (11-12.9). • Understand health effects of particulate matter exposure, Reading Standards for Informational Text (11-12.9). • Career Readiness 10.5 Maintain and troubleshoot equipment used in the energy, environment, and utilities industry.	Students will be able to... • Identify the health risks of PM2.5 materials • Construct a filter to remove PM2.5 from the air

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Exit ticket, class discussions	

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Review social contract	Choose a social contract focus
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Provide commercial air filters for students to explore and deconstruct	Explore and deconstruct commercial air filters and note design features
Communicate *Lesson content, direct instruction, guided practice*	Deliver lecture on PM2.5 and filter construction	Take notes on PM2.5 and filter construction
Empower *Assess, students demonstrate understanding of lesson content*	Provide tools for ideation phase of filter construction Give parameters for the project	Plan construction of filter Identify features that will block PM2.5
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Self evaluation of project plan	Self evaluation of project plan

MATERIALS:

- Slides Template
- Commercial air filters: HVAC filters, carbon filters, car cabin filters, air purifier filters etc.
- Possible parameters and materials: https://discovere.org/engineering-activities/design-an-air-filter/
- Background Information for students: https://www.teachengineering.org/content/cub_/activities/cub_enveng/cub_enveng_lesson07_activity2_info.pdf
- Engineering Challenge worksheet: https://www.teachengineering.org/content/cub_/activities/cub_enveng/cub_enveng_lesson07_activity2_worksheet.pdf

AQ-100 Unit 2 Lesson 2

STANDARDS	**OBJECTIVES**
• Understand impact of particulate matter control technologies (e.g., fabric filters, electrostatic precipitators, scrubbers), Science and Engineering Practices (SEP 6). • Career Readiness 10.5 Maintain and troubleshoot equipment used in the energy, environment, and utilities industry.	Students will be able to... • Construct a filter to remove PM2.5 from the air • Evaluate the effectiveness of the filter and revise based on new knowledge • Describe the function of electrostatic filters and water scrubbers

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Exit ticket, class discussions	Self Evaluation of filter performance

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Review social contract	Choose a social contract focus
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Review safety rules Put students in teams Guide construction of air filters	Build air filters out of given materials in teams Conduct preliminary test using air sensors
Communicate *Lesson content, direct instruction, guided practice*	Lecture, video, or demo on electrostatic filters and water scrubbers	Take notes, adjust air filter design
Empower *Assess, students demonstrate understanding of lesson content*	Guide students through adjusting air filter design and testing	Adjust air filter design and retest
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Distribute and collect exit ticket: Self-evaluation of air filter performance	Complete exit ticket: Self-evaluation of air filter performance

MATERIALS:

- Slides Template
- Particulates: cocoa powder
- Air sensors (built in prior lessons)
- Air filter materials: boxes, cardboard, charcoal filters, tissues, tape, beakers, plastic bags, plastic containers, tape, plastic tubing, scissors, glue, hair dryer
- Water filter video: https://www.youtube.com/watch?v=t6Qeg-fq5dg
- Electrostatic filter video: https://www.youtube.com/watch?v=spnv1PIW6v0

AQ-100 Unit 3 Lesson 1

STANDARDS	**OBJECTIVES**
• Career Ready Practice 9: Work productively in teams while integrating cultural and global competence. • CTE 3.4: Research the scope of career opportunities available and the requirements for education, training, certification, and licensure. • CTE 7.7: Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.	Students will be able to... • Understand the roles at the Sacramento Metropolitan Air Quality Management District • Identify and explain appropriate business etiquette

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Exit ticket, class discussions, quiz	

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Review social contract	Choose a social contract focus
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Provide time for students to explore careers at the Air District Give students time to share	Explore careers at the Air District Share information about the chosen career with peers in brief oral presentation
Communicate *Lesson content, direct instruction, guided practice*	Provide lecture on business etiquette (see materials for lecture options)	Take notes business etiquette lecture
Empower *Assess, students demonstrate understanding of lesson content*	Quiz on business etiquette (see materials A or B) Collect student questions	Quiz on business etiquette Students generate a list of questions to ask at the field trip
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Preview field trip expectations	

MATERIALS:

- Slides Template
- Business quiz A: https://www.isbe.net/CTEDocuments/BMCE-L770017.pdf
- Business quiz B: https://core-docs.s3.amazonaws.com/documents/asset/uploaded_file/552337/Business_Etiquette_and_Social_Skills.pdf
- Business etiquette video: https://www.youtube.com/watch?v=qWbWL0l3ySk

AQ-100 Unit 3 Lesson 2

STANDARDS	**OBJECTIVES**
• CTE 3.4: Research the scope of career opportunities available and the requirements for education, training, certification, and licensure. • CTE 7.7: Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.	Students will be able to... • Understand the roles at the Sacramento Air Management Board • Demonstrate appropriate business etiquette

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Field trip notes, discussions	

ACTIVITIES:

Determined by field trip plan

Possibilities include:

1. Photojournal - students take photos and caption them with key learnings and takeaways
2. Interview questions - students interview staff members about their work

MATERIALS:

Field trip report: AQ-100 Unit 3 Lesson 2 Field Trip Report Template

Midterm
Name: **Date:**

Multiple Choice:

What is the main cause of air pollution?
A) Natural sources like volcanic eruptions and dust storms.
B) The burning of fossil fuels for energy.
C) Industrial processes like manufacturing and mining.
D) Household activities like cooking and cleaning.

What is one of the most dangerous types of air pollution and why is it so harmful?
A) Carbon dioxide, because it traps heat in the atmosphere.
B) Ozone, because it damages the ozone layer.
C) Fine particulate matter (PM 2.5), because it can enter our lungs and bloodstream.
D) Sulfur dioxide, because it causes acid rain.

What are some ways individuals can help reduce air pollution?
A) Using more energy-efficient appliances.
B) Driving less and choosing to walk, bike, or take public transportation.
C) Supporting policies that promote clean air.
D) All of the above.

What is one example of a policy that governments and organizations are implementing to reduce air pollution?
A) Increasing the use of fossil fuels.
B) Building more highways.
C) Promoting cleaner energy sources.
D) Encouraging people to drive more.

What is the main source of fine particulate matter (PM 2.5)?
A) Volcanic eruptions.
B) Dust storms.
C) Vehicle exhaust, industrial emissions, and wildfires.
D) Household activities like cooking.

Midterm
Name: **Date:**

Short Answer:

1. Give two examples of carbon monoxide (CO) producers.

2. What happens when there's too much sulfur dioxide (SOx) gas around? How does it affect nature?

Case Study
Meadowville is a small town experiencing increased rates of respiratory issues among its residents due to growing concerns over a local manufacturing plant's emissions. Recently, higher levels of particulate matter (PM2.5) and nitrogen oxides (NOx) have been detected within the community. Local officials requested assistance from the Sacramento Air Quality Management District to evaluate the extent of pollution and provide recommendations to protect public health.

1. Explain how you would assess the situation. What tools would you use and what would you look for?

2. How should the manufacturing plant reduce their emissions?

3. What health issues will Meadowville residents experience if the plant continues to produce dangerous emissions?

Midterm
Name: **Date:**

KEY

Multiple Choice

- B
- C
- D
- C
- C

Short Answer

1. Anything with an internal combustion engine
2. Anything that runs on wood, natural gas, or propane combustion

Case Study

1. Use air sensors, examine filtration systems, check regulations
2. Use combination of electrostatic and water scrubbers, use low nitrogen fuel, use up to date appliances/technology
3. Premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing

AQ-100 Unit 4 Lesson 1

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Calculate energy use and analyze how changing systems and behavior can impact energy use. • Conduct an experiment and make comparisons based on experimental evidence.

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Energy Audit Analysis (Carbon in My Life)	
AQ-100 Unit 4 Lesson 1 Slides Template	

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	• Watch 2 min video "Efficiency is the Most Important Step" • Teacher leads debrief "How can behavior impact emissions?"	• Students view video with look for: "How can behavior impact emissions?" • Students participate in debrief cold call to provide responses and create a cause & effect chart on board
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	• Teacher distributes main text and red and green sticky notes • Teacher explains reading instructions, read the text, identify sources of carbon emissions on red sticky notes, strategies to reduce emissions in green, and policies to reduce emissions in yellow • Teacher facilitates debrief: organize your sticky notes from left (high impact emission reducing) to right (high impact emission increasing) by calling on spokesperson from each group • Teacher organizes sticky notes along continuum on board	• Students close read Carbon in My Life pages 1-4 students identify *sources* of Carbon emissions on red sticky notes, *strategies* for reduction in green, and *policies* for reduction in yellow (one source per sticky note) • Students use a reciprocal reading strategy to read the text and identify relevant content. • Students work in teams to order their sticky notes along the continuum, determining which sources, strategies and policies are most high impact • Students participate in cold-call to share out

Communicate *Lesson content, direct instruction, guided practice*	• Teacher distributes guided notes for video and key terms"How We Make and Use Energy" and lectureTeacher explains key terms renewable, non-renewable, coal, oil, natural gas, biomass, biofuels, hydroelectric, wind, solar, geothermal, electricity, transportation, and heat • Teacher plays short video "How We Make and Use Energy • Teacher conducts short lecture on relationship between energy consumption and greenhouse gas emissions	•
Empower *Assess, students demonstrate understanding of lesson content*	• Teacher explains Empower task, "students should complete pages 5-9 of "Carbon in My Life" to evaluate their systems & habits and how they contribute to Carbon Emissions • Teacher circulates to troubleshoot/ support	• Students complete as much of pages 5-9 of "Carbon in my Life," getting support from teacher as needed, by filling in the data table on pages 5-9 with any data with which they are familiar and researching any information required to complete the handout using Google.
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	• Teacher explains homework complete remainder of "Carbon in My Life" assignment by analyzing data from your home (Meter, discussion with family, etc.)	• Students note homework and participate in debrief as needed

MATERIALS: *What physical and digital materials are needed for your lesson?*
• "Efficiency is the Most Important Step" • "How We Make and Use Energy • guided notes for video • reciprocal reading strategy • Carbon in My Life Reading

AQ-100 Unit 4 Lesson 2

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Calculate energy use and analyze how changing systems and behavior can impact energy use. • Present findings and suggestions as a result of an energy audit on a school space

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Energy Audit: Behavior, Systems, & Emissions	Energy Audit: Behavior, Systems, & Emissions

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	• Teacher Activity: teacher reviews previous lesson content, overviews the day's agenda and objectives on the slides • Teacher will facilitate students sharing out their past, present or current "good things" • •	• Student Activity: Students will respond to cold call as needed to review previous lesson content, take note of the day's agenda and objectives. • Students will then participate in good things
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	• Teacher Activity: Introduce the concept of an energy audit, explaining its purpose and importance in promoting energy efficiency. • Show a brief video on the big why behind energy audits • Facilitate discussion:Why are energy audits an important process? When and where might we conduct energy audits?	• Student Activity: Watch a brief video on the big why behind professional energy audits. • Discuss: Why are energy audits an important process? When and where might we conduct energy audits?
Communicate *Lesson content, direct instruction, guided practice*	• Teacher plays short video: What is an energy audit? • Explain task: Define an energy	• Student Activity: Watch short video and take notes • Students should then work together to compose a short definition of energy audit and at least three examples of practical suggestions

	audit and give three examples of practical suggestions provided in the video. • Teacher Activity: Provide guidelines and distribute materials for the energy audit, including energy meters, worksheets, and checklists.	• Form small groups and plan their approach to auditing different areas of the school (classrooms, cafeteria, gym).
Empower *Assess, students demonstrate understanding of lesson content*	• Teacher will overview the empower task: "You will select one area of the school campus and, using the provided template, collect and analyze information on your selected area. Work together to prepare suggestions and prepare a presentation of your findings to the class." • Teacher Activity: Monitor groups, providing assistance and ensuring data is accurately collected.	• Student Activity: Visit designated school areas to collect data on energy usage, noting types of lighting, appliances, and other electrical devices, • Students will use the provided template to collect and analyze information on their selected area. • Students will work together to prepare suggestions and prepare a presentation of your findings to the class."
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	• Teacher Activity: Ask each group to briefly present their findings & suggestions for their energy audit. • Guide students to provide glows and grows feedback to each group	• Student Activity: Work together to present your findings and suggestions that resulted from your energy audit. • Provide glows and grows feedback to each group

MATERIALS: *What physical and digital materials are needed for your lesson?*

- Energy meters
- personalenergymeter.xlsm (optional)
- Audit worksheets and checklists
- Access to spreadsheet software or a simple online tool for data analysis
- Projector or smart board for presentations
- Energy Audit Guide for High School Students
- Peer Review sheet

AQ-100 Unit 5 Lesson 1

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Students will interpret visual data sets to make inferences and draw conclusions •

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Data Story 5 Qs	Create a Line Graph

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Lead icebreaker activity "confusing data charts" Lead debrief discussion	Participate in icebreaker activity by ranking the data charts from best to worst Participate in debrief discussion
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Teacher asks: How can data tell a story? Teacher shows example data story: "What will Africa look like in 100 years?" Teacher distributes graphic organizer to students to respond to TBQs: 1. Population Growth • Current Population: • Projected Population (2100): 2. Urbanization • Urban Population (2050): • Challenges Faced by Cities: 3. Key Challenges • Economic: • Social: • Health:	Students engage in brief discussion Students respond to Text-Based Questions: 1. *How might rapid urbanization in Africa contribute to challenges in maintaining air quality in cities?* 2. *What are the potential impacts of increasing population density on public health and air quality in African cities?* 3. *Considering the economic growth in Africa, how could industrial expansion affect air quality and what measures could be taken to mitigate these effects?* 4. *How does the lack of infrastructure in rapidly growing African cities pose a challenge to controlling pollution and ensuring clean air for residents?* Students follow and respond to TBQs about how data is used to tell the story

	● Infrastructure: 4. Opportunities ● Economic Development: ● Urban Planning: ● Education & Health Improvements: Teacher overviews teacher version: **Title: Challenges and Opportunities in Africa's Rapid Population Growth** **1. Population Growth** ● **Current Population:** *Prompt:* "What is Africa's current population?" *Answer:* Approximately 1.2 billion people (as of the text's data). ● **Projected Population (2100):** *Prompt:* "What is Africa's projected population by 2100?" *Answer:* 4.4 billion people. **2. Urbanization** ● **Urban Population (2050):** *Prompt:* "How many Africans are expected to live in urban areas by 2050?" *Answer:* 56.5% of the population, or more than half of Africa's 2.2 billion people. ● **Challenges Faced by Cities:** *Prompt:* "What challenges do rapidly growing cities face in Africa?" *Answer:* Lack of infrastructure, urban poverty, slum housing, overcrowding, and health risks. **3. Key Challenges** ● **Economic:** *Prompt:* "What economic challenges does Africa face due to rapid population growth?"	

	Answer: High poverty rates, unemployment, and the need to create 18 million jobs per year. ● **Social:** *Prompt:* "What are some social challenges mentioned in the text?" *Answer:* Inequality, education access, and conflicts exacerbated by population density. ● **Health:** *Prompt:* "What are the key health challenges tied to population growth?" *Answer:* Spread of diseases like HIV/AIDS and malaria, poor access to healthcare, and malnutrition. ● **Infrastructure:** *Prompt:* "How does population growth strain infrastructure?" *Answer:* Overcrowded cities with insufficient housing, sanitation, and transportation systems. **4. Opportunities** ● **Economic Development:** *Prompt:* "What economic opportunities does population growth present?" *Answer:* Potential for economic growth if properly managed, with opportunities for job creation. ● **Urban Planning:** *Prompt:* "How can urban planning address the challenges of rapid urbanization?" *Answer:* By improving infrastructure, housing, and transportation, and incorporating sustainable practices. ● **Education & Health Improvements:** *Prompt:* "How can education	

	and health be improved as cities grow?" *Answer:* Investment in education, healthcare, and technology, especially in urban areas, can lead to better outcomes.	
Communicate *Lesson content, direct instruction, guided practice*	Lead reading and interpreting visual data Lecture: Notes: Interpreting Graphical D...	Students take notes from the slides to understand how to interpret graphical data
Empower *Assess, students demonstrate understanding of lesson content*	Teacher explains line graph assessment Teacher shows each slide and allows students to respond to each slide Teacher leads debrief on student responses after each slide	Students interpret raw data and respond to various identification and interpretation questions on the slides.

MATERIALS: *What physical and digital materials are needed for your lesson?*
• Notes: Interpreting Graphical Data

AQ-100 Unit 5 Lesson 2

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Students will interpret visual data sets to make inferences and draw conclusions • Students will be able to interpret two visual data sets to create a comparative analysis

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Discussion, Cold Call & Graphic Organizer	• CER Template and Rubric

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	Lead icebreaker activity: How to spot a misleading graph Facilitate discussion: How can graphs be misleading? Lead Good Things	Participate in icebreaker discussion: How can graphs be misleading? Participate in Good Things
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	Teacher divides class into three groups (A, B, C) Teacher explains the task, each group will compose a one sentence summary of the text provided leaving out no essential information. Teacher distributes *information gap* activity, dividing EPA text into three groups (Group A: Then, Group B: Now, Group C: Future Prospects) Teacher leads debrief, soliciting responses and composing a three column chart on board Pollution Then, Now, and Future Prospects	Students engage with text and work together to compose one sentence summary (if helpful groups can use reciprocal reading strategy to assign roles) Students respond to strategic questions Students follow and respond to TBQs about how data is used to tell the story

Communicate *Lesson content, direct instruction, guided practice*	Teacher distributes key vocabulary handout Teacher pre-teaches vocabulary claim, evidence, reasoning Teacher models using graphic organizer with various simple examples	**Students will review the key vocabulary handout.** ● Carefully read through the definitions, examples, and questions on the handout provided by the teacher. ● Highlight or underline any terms or concepts that are new or unclear. **Students will participate in a discussion as the teacher pre-teaches the vocabulary terms: claim, evidence, reasoning.** ● Listen attentively as the teacher explains each term. ● Ask questions if any part of the vocabulary is unclear. ● Take notes on how each term is used in the context of making arguments or presenting information. **Students will observe and take notes as the teacher models how to use the graphic organizer with various simple examples.** ● Watch as the teacher demonstrates how to fill out the graphic organizer, using the terms claim, evidence, and reasoning. ● Pay attention to how the teacher connects the evidence to the claim through reasoning. ● Write down the examples used by the teacher in your own words to reinforce your understanding. **Students will practice using the graphic organizer with their own examples.** ● Apply what you've learned by filling out the graphic organizer with a claim, evidence, and reasoning related to a topic provided by the teacher or chosen by you. ● Share your examples with a partner or the class, and be prepared to explain your reasoning. **Students will reflect on their understanding and use of the vocabulary terms.** ● After completing the graphic organizer, take a few minutes to write down your thoughts on how well you understand the concepts of claim, evidence, and reasoning. ● Consider how you can improve your ability to connect evidence to your claims in future

		assignments or discussions.
Empower *Assess, students demonstrate understanding of lesson content*	Teacher explains empower task: to interpret data and decide which type of graph which best communicate the data set by answering the questions: 1. What is the data showing has been happening over time in Sacramento? 2. Which type of visual graph would best communicate this information and why? Teacher distributes CER poster to interpret, make inferences, and draw conclusions of assigned data set. Teacher will distributes data to each team: https://www.airnow.gov/trends/?city=Sacramento&state=CA&country=USA Teacher will facilitate debrief by calling on each group to present responses to two questions 3. What is the data showing has been happening over time in Sacramento? 4. Which type of visual graph would best communicate this information and why?	**Students will listen to the teacher's explanation of the task.** ● Understand that your goal is to interpret the provided data and decide which type of graph best communicates the trends and patterns over time. **Students will consider the following questions to guide their interpretation:** ● **What is the data showing has been happening over time in Sacramento?** ● **Which type of visual graph would best communicate this information and why?** ● Reflect on these questions as you analyze the data set, focusing on identifying trends, patterns, or changes over time. **Students will receive a CER (Claim, Evidence, Reasoning) poster from the teacher.** ● Use the CER poster to help you organize your thoughts as you interpret the data. ● Make a clear claim about what the data shows. ● Identify the evidence in the data that supports your claim. ● Explain your reasoning for how the evidence supports your claim and why you selected a particular type of graph. **Students will work in teams to analyze the assigned data set.** ● Each team will receive data: https://www.airnow.gov/trends/?city=Sacramento&state=CA&country=USA ● As a team, discuss and interpret the data to answer the guiding questions. ● Collaborate to decide which type of graph (e.g., line graph, bar chart, scatter plot) best visualizes the trends in the data, and be prepared to explain your choice. **Students will participate in a class debrief by presenting their findings.** ● Each group will share their answers to the two guiding questions with the class: ○ **What is the data showing has been**

		happening over time in Sacramento? ○ **Which type of visual graph would best communicate this information and why?** ● Be ready to explain your team's reasoning and how you used the CER framework to arrive at your conclusions.
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	Teacher launches students by asking each student to write one affirmation to someone who has positively impacted their lives	Students write affirmations.

MATERIALS: *What physical and digital materials are needed for your lesson?*
● https://www.airnow.gov/trends/?city=Sacramento&state=CA&country=USA ● Notes: Interpreting Graphical Data ● CER Template and Rubric ● AQC U5L2 Matrix for key vocab ● How to spot a misleading graph - Lea Gaslowitz

AQ-100 Unit 5 Lesson 3

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Students will interpret visual data sets to make inferences and draw conclusions • Students will compare two raw data sets from different locations or time periods

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Discussion, Cold Call & Graphic Organizer	Comparative Analysis

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	• Teacher will lead Good Things and introduce agenda and lesson objectives:	• Participate in Good Things
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	• Teacher explains the activity: Seeing a pattern in the data, by passing out a data set (e.g. avg temp data 1970-2004 reproducible) and asking students to write down immediate impressions • Teacher divides class into three groups (A, B, C) • Teacher explains the task, each group will select a decade from avg temp data 1970-2004 reproducible. Each group must use poster paper to visually communicate one decade worth of data. They can use scatterplot, bar graph, line graph, or area chart. • Teacher should monitor the activity, coaching students as needed	**Students will receive a data set from the teacher and write down immediate impressions.** • Take a few moments to review the data set provided by the teacher (e.g., average temperature data from 1970-2004). • Write down your initial thoughts and observations about the data. What patterns or trends do you notice at first glance? **Students will be divided into three groups (A, B, C).** • The teacher will assign you to one of three groups. • Once in your group, prepare to collaborate with your teammates to complete the task. **Students will select a decade of data and create a visual representation on poster paper.** • As a group, choose one decade from the average temperature data set (1970-2004). • Decide how you want to visually communicate the data for that decade. You can use a scatterplot, bar graph, line graph, or area chart. • Work together to create your visual

		representation on the poster paper provided by the teacher. **Students will collaborate and seek guidance as needed while working on the task.** ● Discuss with your group the best way to present the data and ensure everyone contributes to the creation of the poster. ● If you have questions or need help, ask the teacher for guidance. **Students will prepare to present their visual representation to the class.** ● Once your poster is complete, be ready to explain the data you've visualized, the type of graph you chose, and why it effectively communicates the information. ● Reflect on how well your visual representation shows the patterns or trends in the data.
Communicate *Lesson content, direct instruction, guided practice*	● Teacher leads lecture: Comparative Analysis of Visual Data, using resources from StatTrek: https://stattrek.com/statistics/charts/compare-data-sets?tutorial=AP ● Teacher facilitates debrief discussion using cold call or other total participation technique: ● *Which type of graph do you think is the easiest to use when comparing data sets? Why?* ● *What are the most important things to look for when comparing two sets of data?* ● *How can spotting something unusual in a graph, like an outlier, change what you think about the data?*	● Students take notes using the notetaking document Lecture Notes: How to Compare Data Sets ● Students will participate in a class discussion, responding to questions using the cold call or another total participation technique. ● Students will share their thoughts on which type of graph they find easiest to use when comparing data sets and explain why. ● Students will discuss the key things to look for when comparing two sets of data, focusing on what makes a comparison effective. ● Students will consider and explain how noticing something unusual in a graph, such as an outlier, can change their interpretation of the data.
Empower *Assess, students demonstrate understanding of lesson content*	● Teacher explains Empower activity: ● In your groups, use this website: http://data.giss.nasa.gov/csci/stations/	● Students will work in their groups to research data from two cities using the website provided: http://data.giss.nasa.gov/csci/stations/. ● Students will collaborate to create a single poster that visually communicates the data

	to research data from two cities • Work together to create a single poster that visually communicates data from both cities. • Finally, compare data from both cities by developing two similarity statements and two difference statements.	from both cities. • Students will compare the data from the two cities and develop two statements highlighting similarities and two statements highlighting differences.
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	• Teacher distributes self-evaluation exit ticket	• Students self-evaluate on their poster's accuracy and how well they understood the lesson's content.

MATERIALS: *What physical and digital materials are needed for your lesson?*

- StatTrek: https://stattrek.com/statistics/charts/compare-data-sets?tutorial=AP
- Lecture Notes: How to Compare Data Sets
- avg temp data 1970-2004 reproducible
- AQ-100 Unit 5 Lesson 3 Slides Template

AQ-100 Unit 6 Lesson 1

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Evaluate a PSA purpose, audience, and tone • Evaluate PSA content (organization, development, focus, & accuracy)

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Discussion, Ranking Activity Evaluation Report Sections 1, 2, & 3 of Graphic Organizer PSA	

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	• Do Now: Short Writing "How do you persuade someone to do something? Or Discuss a time when you or someone you know was persuaded to take action. What persuaded them?" • Cold Call to elicit responses to "Do Now" • Lead Good Things	• Participate in Do Now activity • Respond to teacher cold call • Participate in Good Things
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	• Teacher divides class into three groups (A, B, C) • Distribute the Time for Nature PSA • Ask students to work together to determine "What was the purpose, audience, and tone of this ad campaign?" • "What made it successful?"	Students read the text and watch the short videos using reciprocal reading strategy Students discuss guiding questions and determine their response Each group shares their conclusions about the text
Communicate *Lesson content, direct instruction, guided practice*	• Teacher leads brief lecture on essential vocabulary *"purpose, audience, and tone"* • Teacher distributes the blank project rubric to students	• Students take notes to define the essential vocabulary • Students take notes on blank rubric during think aloud, noting elements of excellent project criteria. • Students engage in whole class conversation,

	• Teacher projects a selected ad campaign from the ad council on the board that matches "Excellent" criteria • Teacher uses think aloud to evaluate the ad campaign, noting its *research and synthesis* as well as its *presentation quality* • Teacher engages in whole class conversation *"What are criteria for excellent research, synthesis and presentation quality?"* • Teacher uses student responses to annotate on projected blank rubric • Teacher then reveals excellent criteria by projecting completed rubric	responding to cold call and think-pair-share to provide responses to guiding questions: *"What are criteria for excellent research and synthesis and presentation quality?"* • *Student continue to annotate on blank rubric until they have defined rubric criteria for Excellent, Proficient and Needs Improvement Categories* • *Students check their own handwritten rubric against the final rubric, adding, subtracting, or revising as needed.*
Empower *Assess, students demonstrate understanding of lesson content*	• Teacher divides class into three groups (A, B, C) • Teacher explains the task, each group will be assigned two PSA campaigns from the ad council . They should work to come to a consensus by ranking the PSAs along the PSA effectiveness continuum (1 Needs Improvement-4 Excellent). • Teacher leads debrief activity by having each group share their rankings and rationales and by continuing to refer back to the rubric to encourage greater clarity on rubric criteria and PSA expectations.	• Students work in teams (A, B, and C) to evaluate each ad campaign by applying the rubric criteria. • Groups need to come to a consensus about the effectiveness in each ad campaign and should be prepared to justify their rankings by providing reasons and evidence on the Opinion Continuum: Effectiveness of PSAs • Students engage in debrief discussion by sharing out their PSA evaluation scores and rationales • Students engage in whole group debrief discussion to come to a general consensus of how they would score each PSA
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	• Teacher distributes Graphic Organizer PSA • Teacher explains homework, complete section 1, 2 and 3 of	• Students self-evaluate on how well they understood the lesson's content.

	Graphic Organizer PSA by selecting Air Quality Control topic on which they will create their PSAs (if necessary, create a topic options list of those covered throughout the course)	

MATERIALS: *What physical and digital materials are needed for your lesson?*

- Time for Nature PSA
- The Ad Council
- Reciprocal Reading Cards.pdf
- Opinion Continuum: Effectiveness of PSAs
- (Blank) Rubric Air Quality Control PSA
- Graphic Organizer PSA

AQ-100 Unit 6 Lesson 2

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Conduct research to identify credible sources to integrate into PSA presentation • Synthesize relevant data to integrate into PSA presentations

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**:
Graphic Organizer Sections 4 & 5	

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	• Do Now: "What's the purpose, audience, tone?" Teacher projects visual PSA (example), instructs students to respond to the prompt. • Cold Call to elicit responses to "Do Now" • Lead Good Things	• Participate in Do Now activity • Respond to teacher cold call • Participate in Good Things
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	• Teacher distributes and projects Graphic Organizer PSA and explains purpose of steps 4-5 • Teacher conducts checks for understanding	• Students annotate graphic organizer • participate in checks for understanding
Communicate *Lesson content, direct instruction, guided practice*	• Teacher conducts short lecture, explains .org, .edu, .net and evaluating sources for credibility • Teacher projects this website test, asking students to evaluate different sources for credibility based on handout Evaluating Sources Checklist	• Students take notes • Students evaluate different sources, participating in combination of cold call, turn and talk, and whole class discussion to determine credibility of sources by applying the Evaluating Sources Checklist
Empower *Assess, students demonstrate understanding of lesson content*	• Teacher explains the lesson outcomes: Conduct research to identify credible sources to integrate into PSA presentation	• Students work on computers, using the Evaluating Sources Checklist to identify at least three credible sources to integrate into their PSA

	& Synthesize relevant data to integrate into PSA presentations by completing sections 4 & 5 of graphic organizer	• Students conduct research using student computers to complete sections 4 & 5 of graphic organizers
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	• Teacher explains homework, complete section 6 of graphic organizer and prepare to present their public service announcements in the subsequent class	• Students self-evaluate on how well they understood the lesson's content.

MATERIALS: *What physical and digital materials are needed for your lesson?*

- Evaluating Sources Checklist
- Graphic Organizer PSA
- Credibility test

AQ-100 Unit 6 Lesson 3

STANDARDS	**OBJECTIVES**
• CC Writing 11-12.2 • SEP 4, Analyzing and Interpreting Data	Students will be able to... • Conduct research to identify credible sources to integrate into PSA presentation • Synthesize relevant data to integrate into PSA presentations

ASSESSMENT (Formative):	**ASSESSMENT (Summative)**: Final PSA Presentations

ACTIVITIES:		
	Teacher will:	Students will:
Engage *Icebreaker, Good things, social contract check in, lesson hook*	• Do Now: Visual Layout Do's and Don'ts; if necessary, teacher provides one example (e.g. contrasting colors, too much text, etc.) • Cold Call to elicit responses to "Do Now" • Teacher creates Do's and Don'ts T Chart on board from student responses • Lead Good Things	• Students brainstorm Visual Layout Do's and Don'ts to complete a t-chart • Students participate in cold call to provide responses and create a do's and don't t chart
e**X**plore *Activate prior knowledge, generate interest in lesson, explore lesson topic*	• Teacher distributes Do's and Don'ts of design • Teacher elicits student responses using cold call, *"What should we add to our do's and don'ts lists?"*	• Students read article and use information to add to their t-charts • Students participate in cold-call to complete Dos and Don'ts list on board
Communicate *Lesson content, direct instruction, guided practice*	• Teacher explains days outcome, by the end of the day students should complete their PSA presentations • Teacher provides materials, poster board, pens, markers, etc.	• Students seek clarification as needed.
Empower *Assess, students demonstrate*	• Teacher circulates to provide support	• Students use the graphic organizer, compiled lecture notes throughout the course, and

understanding of lesson content		provided materials to create PSA Posters.
Launch *Feedback, Self-Evaluation, Affirmations, Connect lesson to life content*	• Teacher distributes peer reviews Glows and Grows handouts • Teacher evaluates presentations using rubric • Teacher gathers peer review feedback forms.	• Students present PSA presentations • Students work to provide Glows and Grows feedback during each presentation

MATERIALS: *What physical and digital materials are needed for your lesson?*

- Graphic Organizer PSA
- Peer Review sheet
- Rubric Air Quality Control PSA
- https://infographic.ly/dos-donts-design/