

Name:

Date:

Class:

Pre-Activity Problem Set

Answer the following questions.

1. What is the chemical equation for complete combustion?
2. What pollutants might result if incomplete combustion is occurring?
3. Is NO_x formed from the fuel itself? If not, where does it come from? Yes or No
4. Which fuel has a higher energy content? Gasoline or Diesel

Answer the following questions using the example data in the table below.

Independent Variables			Dependent Variables (concentrations observed at tailpipe)		
Fuel	Formula	Combustion temperature (°C)	CO ₂ (ppm)	VOC (ppm)	NO _x (ppm)
Case 1: Gasoline	C ₈ H ₁₈	1500	3000	30	20
Case 2: Diesel	C ₁₂ H ₂₃	1900	3000	50	40
Case 3: Ethanol	C ₂ H ₅ OH	1500	4000	10	20

5. What is similar about the chemical formulas for all of the fuel sources?
6. What is different about ethanol, and why might that difference result in lower VOCs?
7. Which requires more oxygen to reach complete combustion? Gasoline or diesel? And, why?
8. Which fuel type results in the most NO_x and why?

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9. In the following table, circle the **A** or **B** that best completes the row. Then explain your rationale.

Claim	Evidence	Reason
Vehicle 1 produces more total pollutants than vehicle 2.	We observe higher CO ₂ and higher VOCs in the vehicle 1 data.	A. Vehicle 1 has an older engine. B. Vehicle 1 has a larger engine.
Vehicle 2 exhibits more complete combustion than vehicle 1.	A. We observe more VOCs from vehicle 1 than vehicle 2. B. We observe more VOCs from vehicle 2 than vehicle 1.	Vehicle 2 is newer and operating more efficiently, therefore it is displaying more complete combustion.
A. The combustion in vehicle 1 is hotter. B. The combustion in vehicle 2 is hotter.	We observe more NO _x from vehicle 1 than vehicle 2.	Vehicle 1 has a diesel engine.

Explanations

CHALLENGE QUESTION

10. To the air-fuel ratio plot on the right, add a line for CO₂. Explain your line placement.

