

Student lab sheet: Is the EV always cleaner?

Name: _____ Partner: _____ Class: _____

Part A: Baseline. Press Reset to the starting example. Fill in from Questions 1 and 2 of the lab.

Car	Building (g/mi)	Fuel production (g/mi)	Burning (g/mi)	Lifecycle (g/mi)	t CO ₂ e per year	Smog rating
Tesla Model Y (EV)						
RAV4 Plug-in Hybrid						
RAV4 Hybrid						
Honda CR-V (gas)						

- A1. Which car has the largest “building” emissions? What part of that car explains it?
- A2. For the EV, where does the “burning” happen? Name two fuels that might be burned there.
- A3. Calculate the percent reduction in lifecycle CO₂ from the CR-V to the Model Y.

Part B: Do the math (tool closed). Show units at every step.

- B1. The CR-V burns 411 gallons per year. Each gallon releases 8,887 g CO₂ at the tailpipe. Find its tailpipe CO₂ per year in metric tons.
- B2. The Model Y uses 3,147 kWh per year. The Arizona grid emits 326 g CO₂ per kWh delivered. Find the power-plant CO₂ per year in metric tons.
- B3. Compare B1 and B2 with the tool’s “CO₂ per year from driving only” row. Why are the tool’s numbers a little higher?

Part C: Change one variable. Reset before each test, then change only the setting named.

Test	Model Y lifecycle (g/mi)	CR-V lifecycle (g/mi)	EV payback (miles)	What changed and why
State: West Virginia				
State: Washington				
5,000 miles per year				
25,000 miles per year				
Climate: cold winters				

- C1. In West Virginia, compare the RAV4 Plug-in Hybrid with the CR-V. Explain the result.
- C2. Why does mileage change the payback time in years but not in miles?
- C3. Use Question 4. In how many states does the Model Y beat the CR-V? Which state’s grid is cleanest, and why might that be?

Part E: Your own state (if assigned).

- E1. Our state: _____ Model Y lifecycle: _____ g/mi CR-V lifecycle: _____ g/mi Payback: _____ miles
- E2. Our state’s largest sources of electricity are _____.
- E3. Explain how E2 accounts for E1 in two sentences.

Exit ticket. Under what conditions does an electric car emit less than a gas car over its life? Use one number from today’s lab.

Part D: FRQ

Answer on your own. Show your work and units. (4 points)

A commuter in Arizona drives 12,000 miles per year. A gas SUV gets 30 miles per gallon. Burning one gallon of gasoline releases about 9 kg of CO₂.

- a. Calculate the CO₂ the gas SUV releases from its tailpipe in one year. Show your work.
- b. An electric SUV of the same size uses 0.26 kWh per mile. Arizona's grid emits about 0.33 kg CO₂ per kWh delivered. Calculate the electric SUV's yearly CO₂ from electricity. Show your work.
- c. Building the electric SUV releases about 2,300 kg more CO₂ than building the gas SUV. Using your answers from (a) and (b), calculate how many years it takes the electric SUV to make up this difference.
- d. Identify one change to the electric grid that would shorten this payback time and explain why.