SCHOLASTIC

Try Your

THE HARDEST MATH PROBLEM

GRADE 6

Mia sat on the steps of Sunny Middle School at recess, lost in thought. "Hey, Mia!" Liam called. "What are you thinking about?"

"What we learned about the climate and cars," she said, pointing to the cars passing by on the street.

"You mean the levels of carbon dioxide (CO_2) that are causing the planet to warm?"

"Yeah, and how much CO_2 comes from cars," Mia sighed. Then suddenly she stood up and waved Ichiro, Jazmyn, and Ruben over. "I think we should do something to help!" When everyone gathered around, Mia asked, "Want to start a club about climate change and our community?"

"Yes! We can call ourselves the Climate Crew!" Ruben suggested.

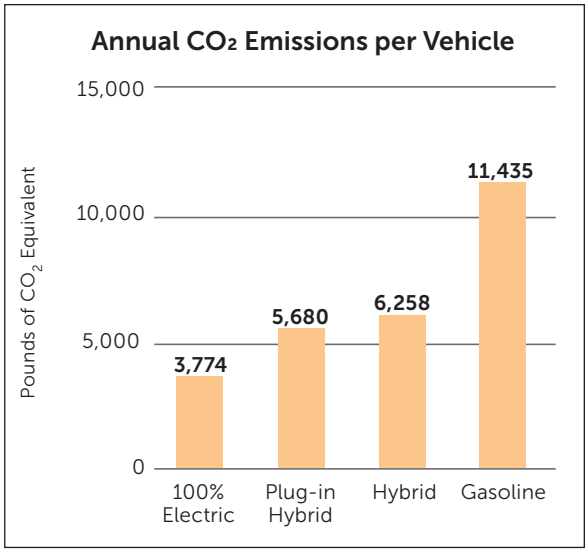
"I'm in," Ichiro said. "We can write letters to the government and businesses."

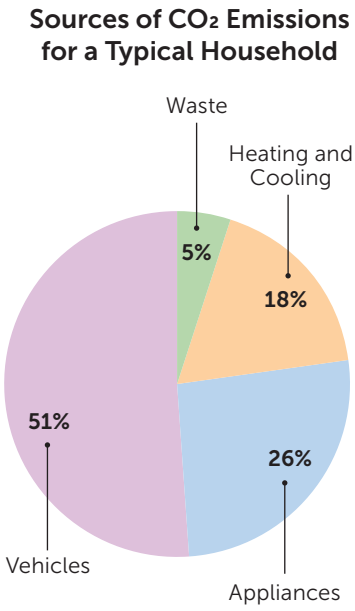
"And we can do our part at home with our families," Jazmyn said.

"Let's get to work," said Liam, pulling out his notebook.

Solve the Problem

While researching, Liam found a graph that shows the annual pounds of CO_2 emissions of four different types of vehicles. Liam connected this information with the chart Mia gave him, showing sources of CO_2 emissions for a typical household. He wondered what this information meant for his family specifically.





Liam's family owns one hybrid car and one gasoline car. Refer to the graph of the sources of CO_2 emissions for a typical household. Liam assumes that his family follows the same proportions. **What is Liam's family's expected pounds of annual CO_2 emissions from their appliances and their heating and cooling, combined? Round the final answer to the nearest integer.**

Try Your

THE HARDEST MATH PROBLEM

CHALLENGE 2 ANSWER KEY — GRADE 6

Although each problem has one correct numeric solution, there are multiple pathways students can take to arrive at the answer.

Step 1: Get the total pounds of CO_2 emissions for the family's hybrid and gasoline vehicles, v, from the bar graph.

v = 6,258 lbs + 11,435 lbs

v = 17,693 pounds of CO_2 emissions

Step 2: Get the total expected pounds of CO_2 emissions for the household, h, using the percentage for vehicles given in the pie chart.

$$\frac{17{,}693\ lbs}{h} = \frac{51}{100}$$

$51h$ = 1,769,300

h = 34,692.157 total pounds of CO_2 emissions for the household

Step 3: Get the total percentage of CO_2 emissions for the family's appliances and heating and cooling, p, using the percentages given in the pie chart.

p = 26% + 18%

p = 44%

Step 4: Get the pounds of CO_2 emissions for the family's appliances and heating and cooling, x.

$$\frac{x\ \text{lbs}}{34{,}692.157\ \text{lbs}} = \frac{44}{100}$$

$100x$ = 1,526,454.908

x = 15,264.549 pounds of CO_2 emissions for the family's appliances and heating and cooling

Final Answer: The family's annual expected CO_2 emissions from their appliances and heating and cooling is **15,265 pounds**.

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THE HARDEST MATH PROBLEM

GRADE 7

Mia sat on the steps of Sunny Middle School at recess, lost in thought. "Hey, Mia!" Liam called. "What are you thinking about?"

"What we learned about the climate and cars," she said, pointing to the cars passing by on the street.

"You mean the levels of carbon dioxide (CO_2) that are causing the planet to warm?"

"Yeah, and how much CO_2 comes from cars," Mia sighed. Then suddenly she stood up and waved Ichiro, Jazmyn, and Ruben over. "I think we should do something to help!" When everyone gathered around, Mia asked, "Want to start a club about climate change and our community?"

"Yes! We can call ourselves the Climate Crew!" Ruben suggested.

"I'm in," Ichiro said. "We can write letters to the government and businesses."

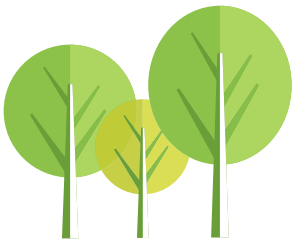
"And we can do our part at home with our families," Jazmyn said.

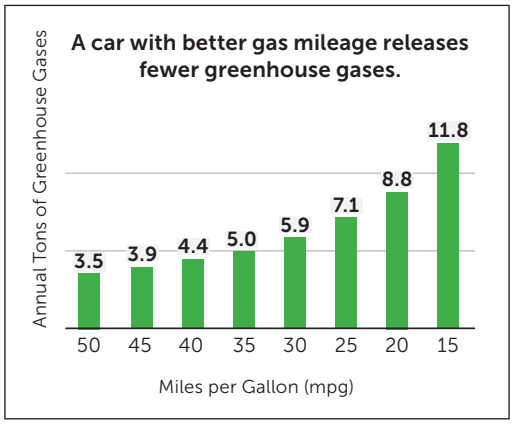
"Let's get to work," said Liam, pulling out his notebook.

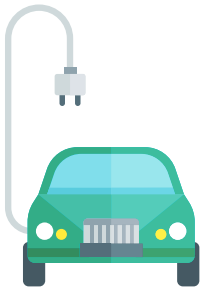
Solve the Problem

Ichiro took out his phone. "*Gas mileage* is the number of miles a car can drive per one gallon of gas. Here's a graph I saw about greenhouse gas emissions and a car's gas mileage."

"I wonder what this means for my family's cars..." Jazmyn mused.







Jazmyn's family owns two cars: one car gets 15 miles per gallon (mpg) and one car gets 30 mpg. She suggested that her family consider trading in the car that gets 15 mpg for a car that gets 25 mpg, as well as trading in the car that gets 30 mpg for a car that gets 40 mpg. While car shopping, the family considers another possibility: Keep the car that gets 30 mpg and trade the car that gets 15 mpg for a car that gets 35 mpg.

The family considers both options (Jazmyn's original idea of trading both cars as well as the idea of keeping one car and trading one car). They choose the option that gives them the greatest decrease in *greenhouse gases* (GHG). **What will be the family's percent of decrease in annual tons of GHG produced by their two vehicles? Round the final answer to the nearest whole percent.**

SCHOLASTIC

Try Your

THE HARDEST MATH PROBLEM

CHALLENGE 2 ANSWER KEY — GRADE 7

Although each problem has one correct numeric solution, there are multiple pathways students can take to arrive at the answer.

Step 1: Get c, the total annual tons of GHG produced by the family's two current cars that get 15 mpg and 30 mpg, from the bar graph.

$c = 11.8 \text{ tons} + 5.9 \text{ tons}$

$c = 17.7 \text{ tons of GHG}$

Step 2: Get n, the total annual tons of GHG that will be produced by the family's potential two new vehicles that will get 25 mpg and 40 mpg, from the bar graph.

$n = 7.1 \text{ tons} + 4.4 \text{ tons}$

$n = 11.5 \text{ tons of GHG}$

Step 3: Get m, the total annual tons of GHG that will be produced by the family's potential one new vehicle that will get 35 mpg and their current vehicle that gets 30 mpg, from the bar graph.

$m = 5.0 \text{ tons} + 5.9 \text{ tons}$

$m = 10.9 \text{ tons of GHG}$

Step 4: Compare n and m to determine which option will give the family the greatest decrease in GHG. Since $10.9 < 11.5$, the option of trading the vehicle that gets 15 mpg for a vehicle that gets 35 mpg and keeping the vehicle that gets 30 mpg will give the family a greater decrease in GHG produced by their two vehicles.

Step 5: Find the difference, d, between c and m.

$d = 17.7 \text{ tons} - 10.9 \text{ tons}$

$d = 6.8 \text{ tons of GHG}$

Step 6: Find the percent decrease of the family's annual tons of GHG produced by their two vehicles, p.

$$\frac{6.8 \text{ tons}}{17.7 \text{ tons}} = \frac{p}{100}$$

$17.7p = 680$

$p = 38.418\%$

Final Answer: By trading in the car that gets 15 mpg for a car that gets 35 mpg and keeping the car that gets 30 mpg, the family will have a **38% decrease (or -38% change)** in the tons of GHG produced by their vehicles each year.

SCHOLASTIC

Try Your

THE HARDEST MATH PROBLEM

GRADE 8

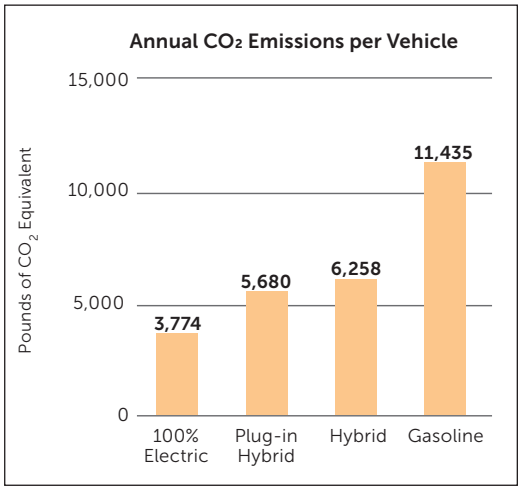
After learning how carbon dioxide (CO_2) emissions cause climate change, Ruben joined up with his friends at Sunny Middle School to form the Climate Crew.

"Burning fossil fuels, like gasoline for cars, is one of the ways humans are releasing a dangerous amount of CO_2 into the environment," Mia said at the first meeting.

"How can we tackle this in our neighborhood?" Ruben wondered.

Solve the Problem

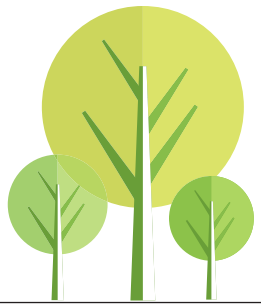
Ruben was intrigued by a graph that Liam found regarding the annual CO_2 emissions of four different types of vehicles. "I wonder if the different annual emissions of these various types of vehicles impacts which cars are sold," he said. "I'll check with a local car dealer."



Ruben discovered that 90% of the local car dealership's sales were gasoline vehicles and the remaining 10% of the sales were equally distributed among the other three types of vehicles. He also found out that the average number of cars sold per month at the car dealership is 240 vehicles. Then, Ruben calculated the annual pounds of CO_2 emissions that would be produced by those 240 cars sold at the current proportions.

Ruben shared the emissions data and his calculations with the owner of the car dealership. "Wow, thanks, Ruben!" the owner said. "You've inspired me to set a goal to move an additional 10% of **total** car sales from the gasoline category to the other types of cars. Then, I'll keep the sales percentages for the other types of cars equally distributed among the three types."

The owner asked Ruben to calculate the percent decrease in annual CO_2 emissions that would result from achieving the goal percentages. **Compared to the current average monthly sales, what will be the percent decrease in annual pounds of CO_2 emissions produced by 240 vehicles sold in one month if the dealership successfully meets its goal? Answer to the nearest whole percent.**



SCHOLASTIC

Try Your

THE HARDEST MATH PROBLEM

CHALLENGE 2 ANSWER KEY — GRADE 8

Although each problem has one correct numeric solution, there are multiple pathways students can take to arrive at the answer.

Step 1: Using the total of 240 new car sales in one month and the current sales percentages, find the number of each type of car sold by the dealership in one month.

- Number of gasoline cars sold, g:
  g = 240 cars × 0.9 → g = 216 gasoline cars
- Number of non-gasoline cars sold, h:
  h = 240 cars × 0.1 → h = 24 non-gasoline cars
- Number of each type of non-gasoline cars sold, k:
  k = 24 non-gasoline cars ÷ 3 types → k = 8 of each type of non-gasoline car

Step 2: Get the total annual emissions of these 240 cars, e.

e = (11,435 lbs of CO_2 equivalent × 216 gasoline cars)

+ (6,258 lbs of CO_2 equivalent × 8 hybrid cars)

+ (5,680 lbs of CO_2 equivalent × 8 plug-in hybrid cars)

+ (3,774 lbs of CO_2 equivalent × 8 cars that are 100% electric)

e = 2,469,960 lbs + 50,064 lbs + 45,440 lbs + 30,192 lbs

e = 2,595,656 lbs of CO_2 equivalent

Step 3: Find the owner's goal for percentage of sales for each type of car.

- Goal percentage of new car sales for gasoline cars, q:
  q = 90% of new car sales – 10% → q = 80% of new car sales for gasoline cars
- Goal percentage of new car sales for non-gasoline cars collectively, r:
  r = 100% – 80% gasoline cars → q = 20% of new car sales for non-gasoline cars

Step 4: Using the total of 240 new car sales in one month, calculate the number of each type of car that would be sold at the goal sales percentages.

- Number of gasoline cars, s:
  s = 240 cars × 0.8 → s = 192 gasoline cars
- Number of non-gasoline cars, t:
  t = 240 cars × 0.2 → t = 48 non-gasoline cars
- Number of each type of non-gasoline cars, v:
  v = 48 non-gasoline cars ÷ 3 types → v = 16 of each type of non-gasoline car

Try Your

THE HARDEST MATH PROBLEM

CHALLENGE 2 ANSWER KEY — GRADE 8

(continued)

Step 5: Get the total annual emissions of these 240 cars, *f*.

f = (11,435 lbs of CO_2 equivalent × 192 gasoline cars)

+ (6,258 lbs of CO_2 equivalent × 16 hybrid cars)

+ (5,680 lbs of CO_2 equivalent × 16 plug-in hybrid cars)

+ (3,774 lbs of CO_2 equivalent × 16 cars that are 100% electric)

f = 2,195,520 lbs + 100,128 lbs + 90,880 lbs + 60,384 lbs

f = 2,446,912 lbs of CO_2 equivalent

Step 6: Get the difference, *d*, in annual emissions for the 240 cars sold in one month at the current percentages and the goal percentages.

d = e − f

d = 2,595,656 lbs of CO_2 equivalent − 2,446,912 lbs of CO_2 equivalent

d = 148,744 lbs of CO_2 equivalent

Step 7: Translate the difference in annual emissions into a percentage.

$$\frac{148{,}744 \text{ lbs}}{2{,}595{,}656 \text{ lbs}} = \frac{p}{100}$$

$p = 148{,}744 \text{ lbs} \times 100 \div 2{,}595{,}656 \text{ lbs}$

$p = 5.73\%$

Final Answer: As compared to the current sales, there would be a **6% decrease (or -6% change)** in annual CO_2 emissions by 240 cars sold in one month if the dealership successfully meets its goal.