

7.5 PROJECT

THE IMPORTANCE OF DIMENSIONAL ANALYSIS

As part of a vacation, a group of American friends travel to Toronto, ON, in Canada and rent a car so they can also visit surrounding areas. While in Canada, the group experiences firsthand the usefulness of learning to convert from the metric system to the US customary system. Keep in mind that prices in Canada are in given in Canadian dollars (CAD) and not US dollars (USD). Assume the current exchange rate is $1.00 \text{ CAD} = 0.80 \text{ USD}$.

1. While renting the car in Toronto, the rental agent tells the group that they can return the car with a full tank of fuel or they can pay 1.999 CAD per liter for the rental company to fill the tank when they return it. Since the current fuel price in the area is 1.279 CAD per liter, the group decides to return the car with a full tank of fuel. The rental car company's policy is to charge the customer for an entire tank of fuel, whether the tank is empty when returned or not. A member of the group looks up the rental car online and learns the fuel tank capacity is 12.5 gallons. How much would the rental company have charged the group to fill the tank with fuel? How much would a full tank of gas have cost the group if they filled it before returning the car?
2. While at a hotel, the group decides to order a pizza from a local pizza parlor. The menu indicates that a small pizza has a diameter of 25 cm, a medium pizza has a diameter of 33 cm, and a large pizza has a diameter of 41 cm. While at home in the states, the group usually orders two 12-inch pizzas. Which pizza size should the group order? Is this an exact match in diameter to the size they usually order?
3. The group plans to drive to Niagara Falls, which is approximately 90 miles from where they are staying in Toronto. The most common speed limit along the route they will take is 100 km/hr. Convert 100 km/hr to mph (miles per hour).
4. Estimate how long it will take to drive from where the group is staying to Niagara Falls (include a time buffer of 15 minutes to account for traffic and any areas with a lower speed limit). Round your answer to the nearest quarter of an hour.
5. The check-in time at their hotel in Niagara Falls is 3:00 p.m. What's the earliest they should leave Toronto if they want to be able to check in upon arrival?
6. Before heading to the falls, the group stops at a grocery store to pick up snacks. They purchase 1.22 kg of grapes that costs 6.08 CAD/kg and 2.39 kg of trail mix that costs 15.67 CAD/kg. (Assume these foods are not taxed.) Determine the cost of the grapes and the trail mix in USD/oz.
7. The grocery store allows payment for the purchase when using a credit card in either USD or CAD. If the credit card used to pay for the purchase is based in the US, a conversion fee of 2.8% is applied if payment is made using CAD. How much would the conversion fee be if the payment is processed in CAD?
8. While in Niagara Falls, the group reads a sign that says the Horseshoe Falls has a width of 670 meters and a height of 51 meters. The sign also indicates that the flow rate is approximately 2,300,000 liters of water per second. Convert the width and height measurements to feet.
9. Determine the flow rate in gallons of water per second.