

Error and measurement

1 That's not precisely accurate...

You are driving through the desert with your friend. You point out a gas station and a sign next to it that says "next gas, 72 miles" He tells that you have $\frac{1}{4}$ of a tank of gas left. Assuming that the tank holds 18.6 gallons, and the car gets 16 miles per gallon, do you have to stop?

2 Where's the error?

Determine where the largest source of error is likely to come from in each of the situations below

2.1 I'm not feeling energetic anymore

You decide to measure the potential energy of an object by measuring its mass with a scale, its height with a ruler, and estimating g as $10 \frac{m}{s^2}$. The formula for potential energy is $E = mgh$. If you measure the mass to be $.002g \pm .001g$ and you measure the height to be $1.1m \pm .1m$, what would you expect to be the largest source of error? Explain why the other two options would not contribute as much to the error.

3 A more open ended example

You are performing a physics lab that involves measuring the volume of an aluminum rectangular prism (basically a 3D closed box that isn't hollow). Your lab group proposes a few possible solutions. Please choose the method that you think would provide the most accurate result and justify your answer. Note that your answer might be different based on your experience with these different methods. The possible solutions are:

- A. Drop the object in a graduated cylinder that has readability of 1mL and measure the change in the water level.
- B. Measure each side with a micrometer accurate to $10\mu m$, then compute the volume. You have only your existing knowledge of how to use a micrometer.
- C. Measure each side of the object using a ruler with readability of 1mm then compute the volume.
- D. measure the mass of the object using a balance with readability of $1\mu g$ and then look up the density of aluminum and use that to calculate the volume.