

Exercise 1.11

Consider the jar of jelly beans in the photo. To get an estimate of the number of beans in the jar you weigh six beans and obtain masses of 3.15, 3.12, 2.98, 3.14, 3.02, and 3.09 g. Then you weigh the jar with all the beans in it, and obtain a mass of 2082 g. The empty jar has a mass of 653 g. Based on these data, estimate the number of beans in the jar. Justify the number of significant figures you use in your estimate. [Section 1.6]



Solution

Calculate the average bean mass.

$$\frac{3.15 + 3.12 + 2.98 + 3.14 + 3.02 + 3.09}{6} \text{ g} \approx 3.08 \text{ g}$$

All of the measured bean masses have uncertainty in the hundredths place, so that's why 3.08 is rounded to the hundredths place—this is the rule for addition and subtraction. Subtract the mass of the jar with beans by the mass of the jar to get the mass of beans.

$$2082 \text{ g} - 653 \text{ g} = 1429 \text{ g}$$

Therefore, there are

$$1429 \text{ g} \times \frac{1 \text{ bean}}{3.08 \text{ g}} \approx 464 \text{ beans}$$

present in the jar. This result is rounded to three significant figures because there are only three in 3.08—this is the rule for multiplication and division.