Exercise 1.50

Carry out the following operations and express the answer with the appropriate number of significant figures.

(**a**) $320.5 - (6104.5/2.3)$

(**b**) $[(285.3 \times 10^5) - (1.200 \times 10^3)] \times 2.8954$

(**c**) $(0.0045 \times 20{,}000.0) + (2813 \times 12)$

(**d**) $863 \times [1255 - (3.45 \times 108)]$

Solution

Part (a)

Round the result of division to two significant figures. Then round the result of subtraction to the tenths place, as both numbers have uncertainty in the tenths place.

$$\begin{aligned} 320.5 - (6104.5/2.3) &\approx 320.5 - (2.6 \times 10^3) \\ &\approx -2279.5 \end{aligned}$$

Part (b)

Uncertainty lies in the ten thousands place of 285.3×10^5, whereas uncertainty lies in the hundreds place of 1.200×10^3. Round the answer to the ten thousands place, then.

$$\begin{aligned} [(285.3 \times 10^5) - (1.200 \times 10^3)] \times 2.8954 &= [(28\,530\,000) - (1200)] \times 2.8954 \\ &= (28\,528\,800) \times 2.8954 \\ &\approx (2.853 \times 10^7) \times 2.8954 \\ &= 82\,605\,762 \\ &\approx 8.261 \times 10^7 \end{aligned}$$

2.853 only has four significant figures, and 2.8954 has five significant figures. That's why the final answer is rounded to four significant figures.

Part (c)

Both products have a number with only two significant figures, so each product is rounded to two significant figures.

$$\begin{aligned} (0.0045 \times 20{,}000.0) + (2813 \times 12) &\approx (9.0 \times 10^1) + (3.4 \times 10^4) \\ &= (90) + (34\,000) \\ &= 34\,090 \\ &\approx 34\,000 = 3.4 \times 10^4 \end{aligned}$$

Uncertainty lies in the ones place of 90, and uncertainty lies in the thousands place of 3.4×10^4. The final answer is rounded to the thousands place, then.

Part (d)

3.45 and 108 both have three significant figures, so the product is rounded to three significant figures.

$$\begin{aligned} 863 \times [1255 - (3.45 \times 108)] &\approx 863 \times [1255 - (373)] \\ &\approx 863 \times (882) \\ &\approx 7.61 \times 10^5 \end{aligned}$$

1255 and 373 both have uncertainty in the ones place, so the difference of these is rounded to the ones place. 863 and 882 both have three significant figures, so the product is rounded to three significant figures.