

Stage 1 

Understanding number: significant figures and rounding

Introduction

Scientists need to record measurements and calculations to an appropriate level of precision. Writing every calculator digit suggests false accuracy, while rounding too much loses important information. We will be building on your rounding skills from maths to learn to use significant figures.

Learning objectives

1. Understand what rounding means and why it is used in science.
2. Understand what significant figures are and why they matter in science.
3. Round numbers to a given number of significant figures.
4. Choose an appropriate number of significant figures when recording measurements and carrying out calculations.

Significant figure and rounding

1. State the number of significant figures (s.f.) and which rule(s) apply.

- a) 302
- b) 0.071
- c) 4.60
- d) 0.500
- e) 10.03

2. Round each example to the given number of s.f.

- a) 3.782 to 2 s.f.
- b) 0.02854 to 2 s.f.
- c) 1647 to 3 s.f.
- d) 0.5985 to 3 s.f.
- e) 7.996 to 3 s.f.



Significant figure and rounding – answers

1.

- a) 3 s.f. Rules 1 and 2
- b) 2 s.f. Rules 1 and 3
- c) 3 s.f. Rules 1 and 4
- d) 3 s.f. Rules 1, 3 and 4
- e) 4 s.f. Rules 1 and 2

2.

- a) 3.8
- b) 0.029
- c) 1650
- d) 0.599
- e) 8.00

Recording answers to the right level of precision

For each question, give your answer to an appropriate number of significant figures or decimal places. Explain your choice.

1. A learner measures the mass of a stone as 34.7 g and its volume as 13 cm³. They calculate density = $34.7 \div 13 = 2.669230769$ on their calculator. How should they record the density?
2. A learner measures three temperatures with a thermometer that reads to 0.5°C: 19.5°C, 20.0°C, 19.0°C. Their calculator gives a mean of 19.5. Is this correct? Explain your reasoning.
3. A learner dissolves 2.5 g of sugar in water and makes 75 cm³ of solution. They calculate concentration = $2.5 \div 75 = 0.033333...$ g/cm³. How many significant figures should the answer give? Explain why.

Recording answers to the right level of precision

- answers

For each question, give your answer to an appropriate number of significant figures or decimal places. Explain your choice.

1. Mass is 3 s.f., volume is 2 s.f. The least precise is the volume (2 s.f.), so the answer should be to 2 s.f. First s.f. is 2, second s.f. is 6. Decider is 6 (≥ 5), round up. **Answer: 2.7 g/cm³.**
2. The mean is 19.5°C, which is to 1 d.p. The thermometer reads to 1 d.p., so **19.5°C is correct.**
3. Both values are 2 s.f., so the answer should be to 2 s.f. Leading zeros are not significant. First s.f. is 3, second s.f. is 3. Decider is 3 (< 5), round down. **Answer: 0.033 g/cm³.**

Discussing significant figure

A learner measures the mass of a liquid as 8.40 g and its volume as 12.0 cm³. They calculate the density on their calculator: $8.40 \div 12.0 = 0.7$.

Three learners are discussing how to record this answer. Which learner has recorded the answer correctly?

Explain why the other two learners are wrong.

The answer is 0.7 g/cm³.
The calculator gave 0.7 so that is the answer.

Learner A

The answer is 0.700 g/cm³.
Both measurements are 3 s.f. so I need 3 s.f. in my answer.

Learner B

The answer is 0.70 g/cm³. The answer should be to 1 d.p. because both measurements are to 1 d.p.

Learner C



Discussing significant figure – answer

Learner B is correct.

Learner A is incorrect because they have just accepted the calculator display. The calculator shows 0.7, which is only 1 significant figure.

The measurements justify 3 significant figure:

- mass = 8.40 g, which is 3 s.f.
- volume = 12.0 cm³ which is 3 s.f.

Both are 3 significant figures; therefore, the answer should be to 3 significant figures.

Learner C is incorrect because they have used the decimal places rule instead of the significant figures rule.

The answer is 0.700 g/cm³. Both measurements are 3 s.f. so I need 3 s.f. in my answer.

Learner B