Counting Significant Figures

Grade 9 – 10 science · measurement

Name: Date: Score: / 26

What significant figures are

A measurement can only be as good as the instrument that produced it. **Significant figures** are the digits that were actually determined by measuring, as opposed to the digits that only show where the decimal point goes.

A balance reading 4.56 g has three significant figures because a person could read three digits off it. In 0.00456 kg the same mass still has three: the zeros at the front are not measurements, they are there because the unit changed.

That is the whole idea, and the rules below are only bookkeeping for it. Before using a rule, ask whether a digit could have come off an instrument. If it could not, it does not count.

The rules

- Every **non-zero** digit counts.
- A zero **between** non-zero digits counts: 4005 has 4.
- A **leading** zero never counts: 0.0045 has 2.
- A **trailing** zero after a decimal point counts: 4.500 has 4.
- A trailing zero in a whole number with no decimal point is **ambiguous**: 4500 is normally read as 2.
- An **exact** number — a count or a definition — has unlimited significant figures.

Part A — How many significant figures? write the number in each box (16 marks)

45.6 ☐	**4005** ☐	**0.0045** ☐	**4.500** ☐
0.01 ☐	**100.10** ☐	**6.022×10^{23}** ☐	**0.000500** ☐
78 ☐	**3.0800** ☐	**0.09** ☐	**1.0×10^{3}** ☐
250.0 ☐	**0.0030** ☐	**9000.** ☐	**12.040** ☐

Part B — Which zeros count? say what each zero is doing (6 marks)

Number	Which zeros count, and why	s.f.
0.0708		
30.00		
0.500		

8000		
2.0070		
0.0010		

Part C — The ambiguous ones (4 marks)

1. Explain why **1200** could be read more than one way, then write it in scientific notation twice: once with the fewest significant figures it could have, and once with the most.

2. Explain why **450** could be read more than one way, then write it in scientific notation twice: once with the fewest significant figures it could have, and once with the most.

Counting Significant Figures — Answer Key

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Part A — How many significant figures?

1. **45.6** → 3
2. **4005** → 4
3. **0.0045** → 2
4. **4.500** → 4
5. **0.01** → 1
6. **100.10** → 5
7. **6.022e23** → 4
8. **0.000500** → 3
9. **78** → 2
10. **3.0800** → 5
11. **0.09** → 1
12. **1.0e3** → 2
13. **250.0** → 4
14. **0.0030** → 2
15. **9000.** → 4
16. **12.040** → 5

Part B — Which zeros count?

1. **0.0708** — The zero between 7 and 8 counts. The two leading zeros do not. 3 s.f.
2. **30.00** — Every zero counts: one is captive, two follow the decimal point. 4 s.f.
3. **0.500** — The leading zero does not count, the two trailing ones do. 3 s.f.
4. **8000** — Ambiguous. Read as placeholders, so 1 s.f.
5. **2.0070** — Two captive zeros and one trailing zero all count. 5 s.f.
6. **0.0010** — Only the 1 and the trailing zero count. 2 s.f.

Part C — The ambiguous ones

1. **1200** ends in a zero with no decimal point, so nothing in the way it is written says whether that zero was measured or is holding the place.
   Fewest: 1.2×10^3. Most: 1.200×10^3. Scientific notation is the fix, which is a large part of why scientists use it.
2. **450** ends in a zero with no decimal point, so nothing in the way it is written says whether that zero was measured or is holding the place.
   Fewest: 4.5×10^2. Most: 4.50×10^2. Scientific notation is the fix, which is a large part of why scientists use it.