SUPPORT Sheet –
Standard form and significant figures

Only complete if practice required

Specification references
- MS 0.1 Recognise and use expressions in standard and ordinary form
- MS 0.4 Use calculators to find and use power, exponential and logarithmic functions
- MS 1.1 Use an appropriate number of significant figures

Learning objectives
After completing the worksheet you should be able to:
- convert between numbers in standard and ordinary form
- state numbers to a certain degree of accuracy.

Introduction - In the calculations you will be asked to perform as part of your AS studies you will need to be confident with both representing numbers in standard form and giving them to a certain number of significant figures.
When numbers are very large or very small they are written in standard form. In standard form a number is written in the format:
  \[a \times 10^n\]
where \(1 \leq a < 10\) and \(n\) is an integer.
In an experiment, or from a calculation, you may only be able to give your answer with a certain amount of accuracy. This accuracy is shown by giving your answer to a certain number of significant figures.

Worked example: Standard form

Question
Express 0.00268 in standard form.

Answer
Step 1
Identify the value for ‘\(a\).’ In this case it will be 2.68.

Step 2
Work out how many places the decimal place must be moved to form this number.

\[0.00268\]
The decimal place must move 3 places to the right to become 2.68.
This number of places is the value for the integer ‘\(n\).’ If the decimal point moves to the right ‘\(n\)’ is negative. If the decimal place moves to the left ‘\(n\)’ is positive.
Step 3
Substitute your values into the general format, \( a \times 10^p \)
Therefore in standard form 0.00268 is \( 2.68 \times 10^{-3} \).

Worked example: Significant figures

Question
Express 0.56480900 to 3 significant figures.

Answer

Step 1
Identify the numbers which are significant using the rules below:

Rule 1 Any number that isn’t 0 is significant.
Rule 2 Any 0 that is between two numbers that are not 0 is significant.
Rule 3 Any 0 that is before all the non-zero digits is not significant.
Rule 4 Any 0 that is after all of the non-zero digits is only significant if there is a decimal point.

In this case the significant numbers are 0.564 809 00.

Step 2
Identify the three most significant figures. These are the significant numbers which are furthest to the left (have the biggest values), i.e., 0.564 809 00.

Step 3
Look at the next number. If this number is 5 or above, then round up. If this number is 4 or less, do not round up.

In this case the next number is 8, so we round up to 0.565.

Questions

1. This question is about expressing numbers in standard form.
   a. Express the following numbers in standard form. (4 marks)
      i. \( 0.0023 \)
      ii. \( 1032 \)
      iii. \( 275 \ 000 \ 0 \)
      iv. \( 0.000528 \)
   b. Write out the following numbers in ordinary form. (4 marks)
      i. \( 2.01 \times 10^3 \)
      ii. \( 5.2 \times 10^{-2} \)
      iii. \( 8.41 \times 10^2 \)
      iv. \( 1.00 \times 10^{-4} \)
c For each of the pairs of numbers below identify which is the bigger number. (3 marks)

i  $1.43 \times 10^{23}$ or $1.43 \times 10^{24}$

ii $5.16 \times 10^{-3}$ or $5.16 \times 10^{-4}$

iii $12.4 \times 10^{23}$ or $1.50 \times 10^{24}$

2 Express the following numbers to the number of significant figures indicated. (6 marks)

a $4.74861$ to two significant figures

b $507980$ to three significant figures

c $809972$ to three significant figures

d $06.345$ to three significant figures

e $7840$ to three significant figures

f $0.007319$ to three significant figures

3 Carry out the following calculations expressing the numbers in standard form to the degree of accuracy indicated: (4 marks)

a $(4.567 \times 10^5) \times (2.13 \times 10^{-3})$ to three significant figures

b $(1.567 \times 10^3) \div (2.245 \times 10^{-1})$ to four significant figures

c $(5.4 \times 10^{-1}) \div (2.7 \times 10^{-3})$ to one significant figure

d $(2.00 \times 10^{-2}) \times (2.00 \times 10^{-4})$ to three significant figures

Maths skills links to other areas

You will use these skills throughout the Amount of substance topics.