Teaching guide: Estimates and significant figures
Mathematics for GCSE Science

This resource helps you to deliver the mathematical requirements that students are required to demonstrate in the new GCSE Science specifications. It consists of a teaching guide and PowerPoint presentation.

1. Arithmetic and numerical computation

Science GCSE subject criteria Maths skill: 1d. Make estimates of the results of simple calculations

1. Brief explanation	• Mental estimates are used frequently in Maths; often before the exact calculation is done on a calculator. They are used to give a ball-park figure for the final answer. • In Maths the word 'Estimate' in a question generally means 'round each number to 1 significant figure before performing the calculation'. • **Some IGCSE Maths specifications do not require non-calculator skills so these students may need extra assistance with this topic.**
2. Statement of coverage from: KS3 Mathematics programme of study (POS) KS4 Mathematics programme of study (POS)	• Use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation a<x≤b • Apply and interpret limits of accuracy when rounding or truncating, {**including upper and lower bounds**}.
3. Maths introduction and development	• Mental arithmetic is introduced from when a student first starts school and is developed through to KS3. • Rounding is first done to 'nearest whole number', nearest 10', etc. before moving on to the introduction of decimal places and significant figures.
4.Ref AQA All About Maths AQA All About Maths Rounding	NEW GCSE Maths (8300) > Foundation tier resources > Number > Rounding **Lesson 1 –** Rounding reminder; leading to decimal places. **Lesson 2 –** Rounding to a number of significant figures. **Lesson 3 –** Upper and lower bounds. **Lesson 4 –** Use of inequality signs; truncating rather than rounding; and appropriate rounding.
5. Misconceptions	These tend to occur when rounding the number rather than the actual calculation. eg What is 14 489 to the nearest 10 000? A student may do this: 14 489 to the nearest 10 is 14 490

	14 490 to the nearest 100 is 14 500
	14 500 to the nearest 1000 is 15 000
	15 000 to the nearest 10 000 is 20 000
	They do it in stages rather than just one step. The correct answer is 10 000.

6. Some examples of where it is applied in science	**Biology** Animal and plant cells
	            Culturing microorganisms (Biology only)
	Chemistry Sizes of particles and their properties (Chemistry only)
	            Calculating rates of reactions
	            Chromatography
	Physics Acceleration
	            Newton's Second Law
	            Factors affecting braking distance

2. Handling data

Science GCSE subject criteria Maths skill: 2a. Use an appropriate number of significant figures

1. Brief explanation	• Mental estimates are used frequently in Maths; often before the exact calculation is done on a calculator. They are used to give a ball-park figure for the final answer. • Students need to be able to round a number to any number of significant figures and decide on the most appropriate number in each situation. • **Some IGCSE Maths specifications do not require non-calculator skills so these students may need extra assistance with this topic.**
2. Statement of coverage from: KS3 Mathematics programme of study (POS) KS4 Mathematics programme of study (POS)	• Round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures] • Apply and interpret limits of accuracy when rounding or truncating, {including upper and lower bounds}.
3. Maths introduction and development	• Rounding is first taught to 'nearest whole number', nearest 10', etc. before moving on to the introduction of decimal places and significant figures. • Students learn that answers often need to be rounded and that an answer should be to a similar degree of accuracy (have same number of significant figures) as the original numbers.
4.Ref AQA All About Maths AQA All About Maths Rounding	NEW GCSE Maths (8300) > Foundation tier resources > Number > Rounding **Lesson 1 –** Rounding reminder; leading to decimal places. **Lesson 2 –** Rounding to a number of significant figures. **Lesson 3 –** Upper and lower bounds. **Lesson 4 –** Use of inequality signs; truncating rather than rounding; and appropriate rounding.
5. Misconceptions	These tend to occur when rounding the number rather than the actual calculation. eg What is 14 489 to 2 s.f.? A student may do this: 14 489 to 14 490 14 490 to 14 500

	14 500 to 15 000
	They do it in stages rather than just one step. The correct answer is 14 000.
6. Some examples of where it is applied in science	**Biology** Culturing microorganisms (Biology only)
	Plant organ system
	Chemistry Moles (HT only)
	Percentage yield (Chemistry only)
	Chromatography