Chapter 5 Metric and imperial measures

Specification

FS coverage and range	Use, convert and calculate using metric and, where appropriate, imperial measures
FS exemplification	Including length, weight, capacity and temperature Conversion graphs Speed Convert between metric units Convert between imperial units Convert between metric and imperial units

GCSE

GCSE specification	**GM o**	Interpret scales on a range of measuring instruments and recognise the inaccuracy of measurements
	GM p	Convert measurements from one unit to another
	GM s	Understand and use compound measures
	A r	Construct linear, **quadratic and other** functions from real-life problems and plot their corresponding graphs

Edexcel GCSE course	**Specification A:** **Foundation** 11.1–11.6, 20.7, 22.1–22.3 **Higher** Chapter 7, 15.3, 15.6, 21.1, 23.3, 23.7 **Specification B:** **Foundation Unit 1:** 1.2, 1.5; **Unit 2:** 12.1–12.3, 17.1–17.6; **Unit 3:** 9.5 **Higher Unit 1:** 1.1, 1.4; **Unit 2:** 9.3, 9.6–9.8, Chapter 12; **Unit 3:** 6.1, 10.4, 11.5, 11.7

Resources

General resources	Show-me boards Rulers, metre rulers, weighing scales, tape measures (optional)
Resource sheets	5.1, 5.2, 5.3
Links	http://news.bbc.co.uk/weather/ http://www.wikipedia.org/wiki/Units_of_measurement http://www.gordonengland.co.uk/conversion http://www.quiz-tree.com/Units_of_Measurement_main.html http://www.phrontistery.info/unit.html http://www.teachingideas.co.uk/maths/contents11measure.htm
ActiveTeach resources	Video ResultsPlus Knowledge Check ResultsPlus Problem Solving Question Audio Animations

Lesson 1

Objectives

- Learn to read and use scales
- Use scales to estimate, measure and compare length, distance, weight, capacity and temperature

Starter

- Ask students to estimate the length, weight or capacity of various objects in the room.
- Briefly discuss how measurements can be given in different units.
- Ask students to give the approximate length, weight or capacity of various objects in specific units. In some cases use the same object while changing the specified units.

Main teaching and learning

- Discuss the uses of measurement in the real world. Ask:
  - *What jobs require measuring skills?*
  - *What instruments are used to measure length, weight, time and capacity?*
  - *What mistakes could occur if objects are incorrectly measured?*
- Ask students to measure the length of their pen/pencil in both metric and imperial measures. Use this example to get students to focus on the process of reading a scale. Discuss how they know each little line represents 1 mm.
- Using *Take a look*: Change in temperature (p52), focus on how to calculate what each individual mark on the scale represents.
- Ask students to complete *Have a go* Q1 and Q2.
- Provide students with the current temperatures of various places around the world, ensuring that some are below zero. Current temperatures can be found at http://news.bbc.co.uk/weather/. Ask students to write the temperature difference between various places on show-me boards. If students struggle to find the difference between positive and negative temperatures, revisit *Take a look:* Change in temperature to discuss how to do it.
- Ask students to complete Q3.

Issues and misconceptions

- In Q2, the scale on the petrol gauge is not labelled. Students may be unaware that they have to 'mentally' complete the scale using the information in the question.

Support

- For Q2, encourage students to sketch the petrol gauge and label the scale.

Extension

- Ask students to compare measurements in different units, using units in the same system and in different systems.

Plenary

- Discuss as a class how you could measure or estimate the following:
  - The volume of an apple
  - The weight of a tack
  - The time it would take to read a dictionary.

Formative assessment

- Assess students' understanding during the temperature difference activity.

Homework

- Ask students to use the internet to find the hottest and coldest places on the planet and calculate the difference in temperature.

Lesson 2

Objectives

- Use units of measure within the same system
- Calculate with units of measure across systems
- Learn to identify the correct conversion factors to work with

Starter

- Write pairs of equivalent measurements on the board and get students to match them up. Continue the activity using the matching cards from Resource sheets 5.1 and 5.2.

Main teaching and learning

- Use the Know Zone (pp50–1) to discuss conversion between metric units. Emphasise that students need to learn these. Discuss how you would use the conversions to convert measurements. For example, ask: *If 1 kg = 1000 g how would you convert 460 g into kg and 6.2 kg into g?* Stress that to convert a large unit into a smaller unit you must multiply the number and to convert a small unit into a larger unit you must divide the number.
- Ask students to complete *Have a go* Q4 (p54) and then discuss the different approaches used. Ask: *Is it easier to find the number of glasses per litre or to divide the total by 0.2? If the squash makes between 10 litres and 12 litres how would the different approximations affect your answer? How have you communicated this in your answer?*
- Read through Q5 and ask students what calculations they need to do to answer the question. Encourage students to take this approach before starting questions. Ask students to complete Q5 and Q6.
- Discuss why we use both imperial and metric units in Britain and then use the Know Zone to identify conversions between metric and imperial units. Ask students to complete Q7.
- Introduce conversion graphs. Give students the kilograms–pounds conversion graph on Resource sheet 5.3. Ask students what each square represents on each axis. Ask them to use the graph to convert several weights from kilograms to pounds and from pounds to kilograms. They can use the graph to find the weight of the turkey in Q8 in kilograms.
- Ask students to complete Q8–10.

Issues and misconceptions

- When writing down their method, students might use 'shorthand' and write, for example, 1.5 = 1500, 7.92 = 7920 and 11 = 11 000. Explain that these statements are not true and that they should write down the full calculations, for example $1.5 \times 1000 = 1500$.
- Students may be unfamiliar with imperial units.

Support

- Encourage students to use the conversion tables in the Know Zone.

Extension

- Ask students to convert 50 miles per gallon into km per litre.

Plenary

- Pose the following question: The Eiffel Tower is 324 metres high. Use the Know Zone to estimate its height in feet.

Formative assessment

- Ask students to write a question similar to those in the *Have a go* sections. More able students should focus on a question involving imperial and metric units. Students should swap books with a partner and complete each other's question. They can then mark each other's answer and give constructive feedback based on accuracy and approach.

Homework

- Ask students to produce a revision sheet showing the conversions for units of measure.

Lesson 3

Objectives

- Identify conversion factors
- Work with compound measures

Starter

- Construct an incorrect graph on the board and ask students to identify the mistakes. Common mistakes that could be included are missing labels (for example, title, axis, key) and incorrect use of scale.

Main teaching and learning

- Introduce the idea of compound measures. Use the example of speed in the Know Zone (p51) and explain how writing a formula in a triangle can help.
- Give students examples of different measures and ask them to identify which ones are compound. For example: 60 mph, 12 miles, 16 g/cm^3, 20 square feet, 6 pints, £3.50/hour, 12 tonnes, 26 customers/hour, etc.
- Read through *Have a go* Q11 (p56). Ask students to work backwards through the question, writing down the key information they need to calculate. For example, the cost of petrol, the amount of petrol in litres, the amount of petrol in gallons and the number of miles travelled.
- Ask students to state the process required to move from one step to the next. Highlight the fact that Khalid's car travels between 46 and 63 mpg. Ask: *What would be an appropriate figure to use?* Ask students to complete Q11.
- Read through Q12 and explain that it is a test of independence and the ability to communicate solutions. Rhetorically ask:
  - *What graphical methods can we use to represent data?*
  - *Which of these is best at showing data over a period of time?*
  - *What must we remember when drawing any graph?*
  - *When comparing data, if I just write a number will an examiner know what I mean?*
- Ask students to complete Q12–14.

Issues and misconceptions

- Students may struggle to decide appropriate axes for the graph for Q12 and to make a decision on how to extend the graph to form a prediction. Ensure that students scale their chart or graph correctly.

Support

- Scaffold Q13 and Q14 using similar questioning to that shown above for Q11 and Q12. For Q14, encourage students to sketch and label the diagram.

Extension

- For Q12, ask students to find the rate of change in population density over the last 50 years.

Plenary

- Ask students to write down three points to remember when communicating solutions.

Formative assessment

- Ask students to peer-assess answers to Q11–14, focusing on how information has been communicated.

Homework

- Ask students to use the information in Q13 to estimate the cost of their own water usage. They should identify ways in which they could save water and calculate the amount of money they would save in a year.