Unit 10
Measures and problem solving

Five daily lessons

National Numeracy Strategy

Year 5
Summer term

This Unit Plan is designed to guide your teaching.
You will need to adapt it to meet the needs of your class.

Unit Objectives

Year 5

• Use, read and write standard metric units (km, m, cm, mm, kg, g, l, ml), including their abbreviations, and relationships between them. Convert larger to smaller units (e.g. km to m, m to cm or mm, kg to g, l to ml). Know imperial units (mile, gallon, pint).	Page 91
• Use units of time; read the time on a 24-hour digital clock and use 24-hour clock notation such as 19:53. Use timetables.	Pages 99, 101
• **Use all four operations to solve simple word problems involving numbers and quantities** based on 'real life', money and measures (**including time**), using one or more steps, including making simple conversions of pounds to foreign currency and finding simple percentages. **Explain methods and reasoning.**	Pages 82–89

Link Objectives

Year 4

- Use, read and write standard metric units (km, m, cm, mm, kg, g, l, ml) including their abbreviations, and imperial units (mile, pint).
- **Know and use the relationships between familiar units of length, mass and capacity.** Know the equivalent of one half, one quarter, three quarters and one tenth of 1 km, 1 m, 1 kg, 1 litre, m, cm, g, ml.
- Use, read and write the vocabulary related to time. Estimate/check times using seconds, minutes, hours. Read the time from an analogue clock to the nearest minute, and from a 12-hour digital clock. Use am and pm and the notation 9:53. Read simple timetables and use this year's calendar.
- Use all four operations to solve word problems involving numbers in 'real life', money and measures (including time), using one or more steps, including converting pounds to pence and metres to centimetres and vice versa.

Year 6

- Use, read and write standard metric units (km, m, cm, mm, kg, g, l, ml, cl), including their abbreviations, and relationships between them. Convert smaller to larger units (e.g. m to km, cm or mm to m, g to kg, ml to l) and vice versa. Know imperial units (mile, pint, gallon, pound, ounce). Know rough equivalents of lb and kg, oz and g, miles and km, litres and pints or gallons.
- Appreciate different times around the world.
- **Identify and use appropriate operations (including combinations of operations) to solve word problems involving numbers and quantities** based on 'real life', money or measures (including time), using one or more steps, including converting pounds to foreign currency, or vice versa, and calculating percentages such as VAT. **Explain methods and reasoning.**

(Key objectives in bold)

Resources needed to teach this unit:

- Resource sheet 10.1
- OHT 10.1
- OHT 10.2
- Whiteboards
- Digital clock (24-hour)
- Analogue clock
- Calculators
- 1 pint container
- 1 litre measuring jug with ml marked
- Transparent container to hold at least 1 gallon
- Self-assessment sheet 10.1

department for education and skills

Planning sheet	Day One	Unit 10 *Measures and problem solving*	Term: *Summer*	Year Group: *5*

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Use, read and write standard metric units, including their abbreviations and relationships between them. Convert between units. VOCABULARY metre (m) centimetre (cm) millimetre (mm) kilogram (kg) gram (g) litre (l) millilitre (ml) RESOURCES Whiteboards	• Establish relationships between m and cm; m and mm; kg and g; l and ml. Record them on the board. • Ask the children to convert between units of length, then mass, then capacity and show answers on whiteboards. For example: - The door is 2 m high. How many cm is that? How many mm? - A4 paper is 21 cm wide. How many mm wide is it? - A4 paper is 297 mm long. What is its length in cm? - A bag of flour weighs 2 kg. How many g is that? How many g in $^{3}/_{4}$ of a bag of flour? - This bottle holds 568 ml. How do we show that in litres? etc. • Ask questions involving simple fractions of 1 m, 1 kg, and 1 litre, e.g. - What is $^{1}/_{10}$ of 1 m in metres? in cm? in mm? - What is $^{1}/_{100}$ of 1 kg in kg? in g? - What is ¼ of 1 litre in ml? - What fraction of 1 litre is 750 ml? etc.

Main Teaching

Objectives and Vocabulary	Teaching Activities
Know imperial units (pint, gallon). Solve word problems involving numbers and quantities based on measures. VOCABULARY capacity metric imperial pint gallon approximately equal RESOURCES 1 pint container 1 litre measuring jug with ml calibrations Transparent container that will hold at least 1 gallon	• Say that we now use the European metric system for most aspects of measurement but that the imperial system is still used in the USA. **Q** Which imperial units of measurement do you know? Record all suggestions on the board and discuss their rough metric equivalents. Ensure that pint and gallon are included. Point out that the American gallon is different to the British gallon. • Show the 1 pint container and ask a child to fill it, then empty the water into the litre jug and measure it in ml as accurately as possible. Establish that 1 pint is approximately 570 ml, a little more than half a litre. Explain that a closer equivalent to 1 pint is 568 ml. Record 1 pint ≈ 568 ml on the board. Remind the class that the sign means 'approximately equal to'. **Q** Approximately how many ml are there in 2 pints? How many litres is that? • Ask the children to work out and record the approximate equivalent. Take feedback, asking for methods of calculation to be explained. Repeat with 4 pints and 8 pints. Ask the children to round each of their litre approximations to the nearest tenth of a litre. Record these approximate equivalents on the board. • Explain that 8 pints = 1 gallon in the imperial system. Ask eight different children to measure 1 pint and pour it into the large transparent container. Establish that there is 1 gallon or approximately 4.5 litres of water. Record 8 pints = 1 gallon ≈ 4.5 litres on the board. **Q** What do you think we might have bought in pints and gallons? Discuss suggestions. Ensure that milk, juice, beer and fuel such as petrol are included. • Set the following problem for children to discuss and solve in pairs: 1. The petrol tank of a car holds approximately 12 gallons. Petrol costs about (80p) per litre in Britain. How much will it cost to fill the empty tank? 2. A water butt holds 20 litres of water when full. A gardener has a watering can holding half a gallon of water. How many times can he fill this can from the water butt? 3. A cup holds 200 ml. A cup of coffee costs £1.15. How much money will be taken if all the coffee from an urn holding 3 litres is sold? 4. Mrs Smith buys 2 pints of milk a day. How many litres of milk does she buy in a week? Ask the children to record their calculations and show the methods used.

Plenary

Teaching Activities/Focus Questions

• Ask the children to explain how they tackled the problems and how they calculated the answers. Include details about operations used and about methods of calculation. Identify an efficient solution, recording each stage on the board. Draw out why it is efficient.

By the end of the lesson the children should be able to:

- **Recognise that a pint is a unit of capacity and is slightly more than half a litre;**
- **Recognise that a gallon is equal to 8 pints and is a little bit less than 5 litres;**
- **Solve problems involving litres, millilitres, pints and gallons and explain and record how the problem was solved.**

(Refer to supplement of examples, section 6, pages 87 and 91.)

Planning sheet	**Day Two**	**Unit 10 *Measures and problem solving***	**Term: *Summer***	**Year Group: *5***

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Use, read and write standard metric units, including their abbreviations and relationships between them (km, m). VOCABULARY kilometre (km) metre (m) RESOURCES Whiteboards	• Remind the class that long distances are measured in m and km in the metric system. Establish the relationship between km and m: **Q** How many metres are there in 1 kilometre? What fraction of 1 kilometre is 1 metre? Record: 1 km = 1000 m; 1 m = $^{1}/_{1000}$ = 0.001 km on the board. • Ask questions involving conversion between km and m and vice versa, e.g. How many metres are equivalent to 3 km? 4.5 km? 0.85 km? How many km are equivalent to 1653 m? 2450 m? 700 m? Ask the children to discuss and work out the answer in pairs each time. Take feedback and record each equivalent on the board. • Ask similar questions for the children to answer using whiteboards.

Main Teaching

Objectives and Vocabulary	Teaching Activities
Know imperial unit (mile). Solve word problems involving numbers and quantities based on measures. VOCABULARY mile imperial metric RESOURCES Calculators Self-assessment sheet 10.1	**Q** What unit could we use to measure long distances? Establish that the mile is still used in Britain but the kilometre is used in other parts of Europe. Discuss the rough equivalent established in previous units (e.g. 1 km is slightly more than ½ mile), then establish that 8 km is approximately equal to 5 miles and record on the board. **Q** What is the relationship between 1 mile and 1 km? Ask the children to discuss this in pairs. Take feedback, establish and record 1 mile ≈ $^{8}/_{5}$ km and 1 km ≈ $^{5}/_{8}$ mile. **Q** How could we convert $^{8}/_{5}$ and $^{5}/_{8}$ to decimals? Establish that $^{8}/_{5}$ is equivalent to $^{16}/_{10}$, i.e. 1.6. Use a calculator to convert $^{5}/_{8}$ to a decimal (or establish that $^{1}/_{8}$ = 0.125 so $^{5}/_{8}$ = 0.625). Record 1 mile ≈ 1.6 km or 1600 m and 1 km ≈ 0.625 miles on the board. • Provide a table containing names of local towns/villages and the distance from the school for the children to complete. Some distances should be given in miles and some in km: **Place** / **Distance from school** (in miles / in km) Northplace: 5 miles Westplace: 4.8 km Ask the children to work in pairs to convert these distances to km or miles using a suitable approximation from the board and an appropriate method of calculation, i.e. try mental calculation first, then a written method or use a calculator if necessary.

Plenary

Teaching Activities/Focus Questions

- Discuss the activity. Ask the children to give each equivalent distance and to explain how they worked it out. Address any misconceptions which emerged.
- Say that a can of cola is about 10 cm high.

Q If the cans were laid end to end, how many cans would be needed to cover a distance of 1 mile?

Set the children to work in groups solving the problem.

- Collect solutions and the methods the children used, e.g. 10 cans in 1 m, 10 x 1000 cans in 1 km, 10 x 1000 x 1.6 in 1 mile so about 16 000 cans are needed.

Allow time for calculation then take feedback.

HOMEWORK – Ask the children to find out the approximate distances between London and York, London and Glasgow, London and Paris in miles, then convert these to km.

- Introduce the Self-assessment sheet 10.1.

Give the children a few minutes to complete the first cloud question.

By the end of the lesson the children should be able to:

- **Recognise that a mile is a unit of distance and is about 1600 m, a bit more than 1.5 km;**
- **Solve problems involving miles and kilometres and explain how the problem was solved.**

(Refer to supplement of examples, section 6, pages 87 and 91.)

Planning sheet	Day Three	Unit 10 *Measures and problem solving*	Term: *Summer*	Year Group: *5*

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Add or subtract any pair of two-digit numbers. VOCABULARY digit sum total	• Write these numbers on the board: 39, 95, 17, 86, 48, 63, 19, 51, 77. **Q** The total of two numbers is 96. Which numbers did I add? **Q** How did you work it out? **Q** The difference between two of these numbers is 24. What are the two numbers? Ask the children to work in pairs making up their own questions. Encourage them to use a range of vocabulary. Take feedback from the children. **Q** How did you work it out? **Q** Are there other ways? Use the children's methods/strategies, e.g. empty number line, near doubles, etc. to answer similar questions.

Main Teaching

Objectives and Vocabulary	Teaching Activities
Use units of time; read the time on a 24-hour digital clock and use 24-hour clock notation, such as 19:53. VOCABULARY analogue digital 24-hour clock pm (post-meridian) am (ante-meridian) RESOURCES Digital clock Analogue clock	• Review the homework: **Q** What is the distance from London to York in miles? Discuss level of accuracy/approximation. **Q** What difference will the approximation make to the conversion to km? How many km is it from London to York? • Show the children the two clocks and establish which is analogue and which is digital. **Q** What is the time now? How else could we give the same time? Discuss the different methods and record, e.g. 9:45 am; 45 minutes past nine; quarter to ten; 09:45. • Focus on 09:45 and explain that digital times are recorded without am or pm by using 24-hour clock notation. Write 13:45 on the board and ask a volunteer to suggest what it means. Use the clocks to establish that it is the equivalent to 1:45 pm. Record 13:45 = 1:45 pm on the board. Repeat with other examples of 24-hour clock notation. Focus on post-meridian examples, e.g. 13:45 and 1:45 pm. **Q** Can anyone see a connection between each pair? Establish that the notation for pm 24-hour clock time is 12 hours more than the 12-hour clock notation. • Ask the children to write the 24-hour digital notation on their whiteboards in response to: **Q** What time will it be in 1 hour after 09:45? 2 hours? 3 hours? 4 hours? Check to ensure that the children are recording correctly. • Explain that the sun rises in New York five hours later than it does in London because of the rotation of the Earth around the sun. Consequently, times in New York are five hours earlier than those in Britain. Ask questions such as: **Q** What time will it be in New York at the moment on a 24-hour clock? **Q** What time will it be in New York when we finish school? What about when you get up in the morning? Record the times using 24-hour notation. • Ask the children to write a list of events at different times throughout a typical day and to write the times using 24-hour clock notation. They then record the time it will be in New York for each event.

Plenary

Teaching Activities/Focus Questions

- Ask a few children to read out their lists.
- Write some 12-hour and 24-hour digital times on the board incorrectly, e.g. 03:40am, 9:00, 15-50, 16.00, etc. Ask children to identify each error and to give the correct notation.
- Ask questions such as the following for the class to answer together orally;

Q What time will be displayed on a 24-hour clock when it is: Half past six in the morning? Half past six in the evening? Quarter to eleven in the evening? Nine o'clock in the morning? 12 o'clock at night? etc.

By the end of the lesson the children should be able to:

- **Read the time to the minute on a 24-hour digital clock;**
- **Understand 8:48 am, 8:48 pm, 08:48 and 20:48.**

(Refer to supplement of examples, section 6, page 101.)

Planning sheet	Day Four	Unit 10 *Measures and problem solving*	Term: *Summer*	Year Group: *5*

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Identify pairs of factors of two-digit numbers. VOCABULARY factor divisible RESOURCES Whiteboards	• Remind the class about factors. **Q** What is a factor of a number? Establish that it is a whole number that the other number can be divided by exactly. **Q** Is 6 a factor of 12? What other number goes with 6 to make a pair of factors of 12? What other pairs of factors of 12 do you know? Record the pairs on the board, e.g. 6, 2, 3, 4, 12, 1. • Ask the children to show pairs of factors for other numbers, e.g. 15, 16, 17 on their whiteboards. Collect and record all the pairs on the board. • Write 18, 20, 24 on the board. Allow about five minutes for children to work with a partner and record all the pairs of factors of each number. • Take feedback and record on the board all the pairs for each number. **Q** What strategies did you use to make sure you had found all the pairs? Establish that starting with 1, then 2, 3, etc. is a useful strategy.

Main Teaching

Objectives and Vocabulary	Teaching Activities
Use units of time; use 24-hour clock notation. Use timetables. VOCABULARY timetable RESOURCES OHT 10.1 OHT 10.2 Self-assessment sheet 10.1	• Show OHT 10.1. Say that this is a train timetable. Explain that the train from London to York only stops at Doncaster. Ask questions such as: **Q** When does the 1:30 pm train from London arrive in Doncaster? **Q** How long does the first train of the day take to travel from London to York? **Q** Which train takes the least time to get to Doncaster from London? Collect and discuss answers. • Show OHT 10.2. Say that this is a local bus timetable. Focus on column A and ask questions such as: **Q** What time does the 08:15 arrive at Enderby? **Q** How long does it take? **Q** How long does it take to get from Closeby to Furtherton? **Q** Which is the shortest journey from one stop to the next? Each time discuss how the answer was worked out. Continue with similar questions until the children are confident. • Focus on column B. Ask the children to supply each of the missing times, if necessary asking questions to help their thinking. Ask them to explain how they worked out the answers. • Ask the children in pairs to work out the missing times in columns C and D. Take feedback and record the times on the OHT. • Ask the children to work out a return timetable for buses which leave Enderby at 09:00, 12:45 and 18:20.

Plenary

Teaching Activities/Focus Questions
• Discuss the return timetable and agree times for each place on the list. • Ask questions such as: **Q** A woman reached Nexton bus stop at 08:16. How long did she have to wait for a bus? **Q** How much time is there between bus A and bus B? **Q** What time will an analogue clock show when bus C arrives at Enderby? **Q** What times in the afternoon do buses leave Nexton? **Q** To get to Mainton by 2:15 pm, which Farby bus must I catch? Ensure the children have remembered: 12-hour clock times may have one or two digits before the colon; 24-hour clock times always have two digits before the colon; 24-hour clock times after noon are always greater than 12; an afternoon time of, for instance, 4.30 pm, will always be 12 hours more on a 24-hour clock than a 12-hour clock. • Give out Self-assessment sheet 10.1. Give the children enough time to attempt both the second and third cloud questions. **By the end of the lesson the children should be able to:** • **Use a train and a bus timetable to answer questions about journey times.** (Refer to supplement of examples, section 6, page 101.)

Planning sheet	Day Five	Unit 10 *Measures and problem solving*	Term: *Summer*	Year Group: *5*

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Find simple percentages. VOCABULARY percent equivalent fraction RESOURCES Whiteboards	• Remind the children that percent means in every hundred. **Q** What fraction is equivalent to 10%? 20%? 50%? 25%? 75%? Establish simple forms for each, e.g. 10% = $^1/_{10}$; 20% = $^2/_{10}$ or $^1/_5$; 50% = ½; 25% = ¼; 75% = ¾. **Q** How could we work out 20% of £6? Establish that $^1/_{10}$ of £6 is 60p, 20% is double 10% or $^1/_{10}$, so 20% of £6 = £1.20. **Q** How can we work out 25% of £6? 75% of £6? Encourage the children to recognise that: 25% is $^1/_2$ of 50%, i.e. $^1/_2$ of $^1/_2$ of £6; 75% is 50% + 25%, i.e. £3 + £1.50. • Ask questions involving finding simple percentages of whole number quantities for the children to answer using whiteboards, e.g. 20% of £30; 60% of £200; 75% of 800 ml, etc. Collect and discuss methods and solutions.

Main Teaching

Objectives and Vocabulary	Teaching Activities
Use all four operations to solve simple word problems involving numbers and quantities based on money and time, using one or more steps, including making simple conversions of pounds to foreign currency and finding simple percentages. VOCABULARY percent currency RESOURCES Resource sheet 10.1 Self-assessment sheet 10.1	• Write $1 on the board and ask the children to discuss in pairs what it means. Take feedback and establish that it represents one dollar, the currency in the USA. Repeat with $1.50, establishing that it means 1 dollar and 50 cents. **Q** How many cents make one dollar? Discuss that $1.50 means 1½ dollars, so 50 cents is ½ a dollar, etc. Link this to British currency, and establish that cents and pence are hundredths of dollars and pounds respectively. • Discuss the current exchange rate between $s and £s expressed to no more than two decimal places and record on the board, e.g. £1 = $1.53. **Q** How many dollars is £2 worth? How did you work it out? Repeat with other simple conversions of whole pounds to dollars, including £10, £100 and £400. • Ask simple problems including several steps for the children to discuss in pairs, taking feedback about methods used each time. **Q** In the USA a pair of jeans costs the equivalent of £20. How much change would you get from $50? **Q** A meal for a family in a New York café costs the equivalent of £25. How much is that in dollars? **Q** A hotel gives 20% off the normal price of a room when booked for three or more nights. The usual price is £50 per night. How many dollars will it cost for three nights? • Give out Resource sheet 10.1. Explain that it is about a journey to the USA. (If necessary change the starting time to an appropriate time for your own location.) Ask the children to solve the problems and show their working in their books.

Plenary

Teaching Activities/Focus Questions
• Ask the children to explain how they solved each of the problems. Agree the answers. • Return to percentages. **Q** What is 25% of a day? How do you know? **Q** How many hours do you spend in school each day? What percentage of the day is that? **Q** In pairs discuss and estimate 10% of a week, a month, a year. What units did you use and why? ASSESSMENT – Give out Self-assessment sheet 10.1. Remind and discuss with the children what they have been learning over the week. Ask them to identify on the sheet an area of mathematics they want to get better at. **By the end of the lesson the children should be able to:** • **Solve problems involving money, including converting pounds to dollars and calculating simple percentages;** • **Solve problems involving time, including using timetables and 24-hour clock notation;** • **Explain and record how the problem was solved.** (Refer to supplement of examples, section 6, pages 85 and 89.)

Train Timetable

Train	A	B	C	D	E
London	06:15	07:30	09:00	09:30	11:30
Doncaster	08:08	09:17	10:33	11:11	13:13
York	08:31	09:40	10:58	11:35	13:38
F	**G**	**H**	**I**	**J**	**K**
12:30	13:30	14:30	15:30	16:30	18:00
14:06	15:06	16:03	17:05	18:11	19:26
14:30	15:28	16:27	17:27	18:34	19:52
L	**M**	**N**	**O**	**P**	**Q**
18:30	17:00	19:00	20:00	21:00	22:00
20:17	20:38	20:37	21:32	22:45	23:58
20:41	21:02	21:02	22:56	23:12	00:25

Bus Timetable

Bus	A	B	C	D
Mainton	08:15		14:45	17:20
Closeby	08:22	11:37		
Nexton	08:30	11:45		17:35
Furtherton	08:43		15:13	
Farby	08:55			18:00
Enderby	09:03	12:18		

This is a timetable for a journey from England to New York:

Taxi from home to station	07:20
Train to London	07:45
Train to Heathrow airport	09:05
Plane takes off	13:10
Plane lands in New York	19:50
Taxi from airport arrives at hotel	21:55

1. How long does the whole journey take?

2. The train from London to Heathrow takes about 30 minutes. When would it arrive at Heathrow?

3. How long does it take to fly from Heathrow to New York?

4. If the taxi journey from New York airport to the hotel takes 37 minutes, when did it leave the airport?

5. When it is 12:00 in London it is 07:00 in New York. What time will the New York clocks show when the plane arrives?

6. The return journey home takes the same amount of time. Let's say you leave the New York hotel at 08:30. What will the English time be when you reach home in England?

7. The plane ticket cost £350.00. What would the ticket cost in dollars?

8. The airline has a special offer of 10% off flights in October. What is the reduced price for a ticket to New York in dollars?

My Mathematics

Change 4 km into m, then into miles. Change 200 miles into km.

My Calculations

4 km = ☐ m

4 km is about ☐ miles

200 miles is about ☐ km.

Show or discuss with a friend

I did this:
On my own ☐
With some help ☐

Write ten to eight in the evening as a time on a 12-hour clock and as a time on a 24-hour clock.

My Calculations

Ten to eight in the evening is:

☐ : ☐ (12-hour clock)

☐ : ☐ (24-hour clock)

Show or discuss with a friend

I did this:
On my own ☐
With some help ☐

Train	I	J	K
London	15:30	16:30	18:00
Doncaster	17:05	18:11	19:26
York	17:27	18:34	19:52

My Calculations

To get from London to Doncaster Train J takes: ☐

The quickest train from Doncaster to York is Train ☐

The slowest train from London to York takes: ☐

Show or discuss with a friend

I did this:
On my own ☐
With some help ☐

Name: _____

I want to get better at _____

_____

_____