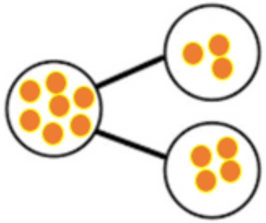
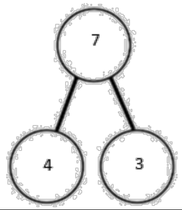
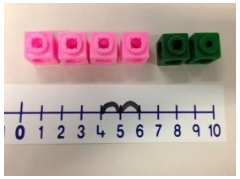
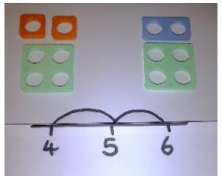
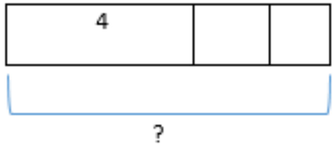
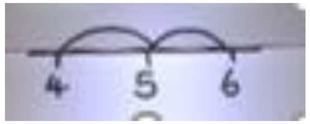
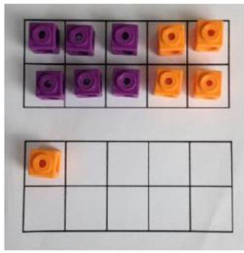
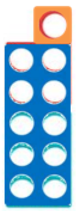
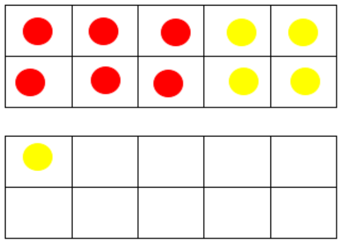
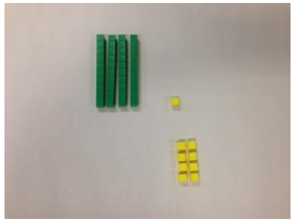
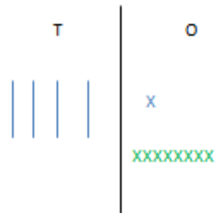
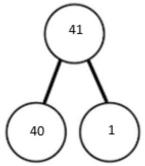
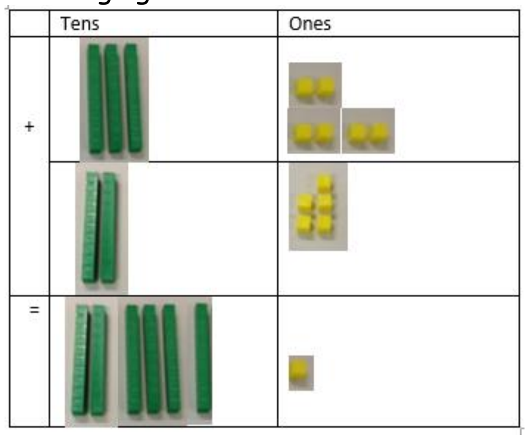
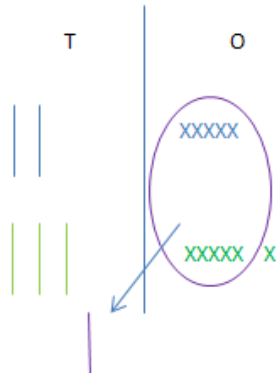
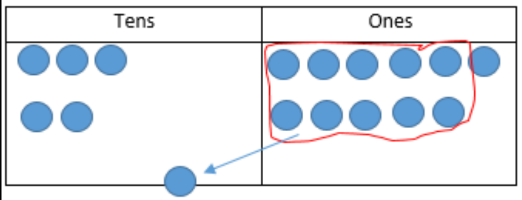
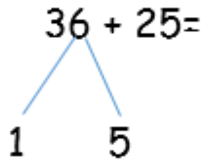
Maths Calculation Policy

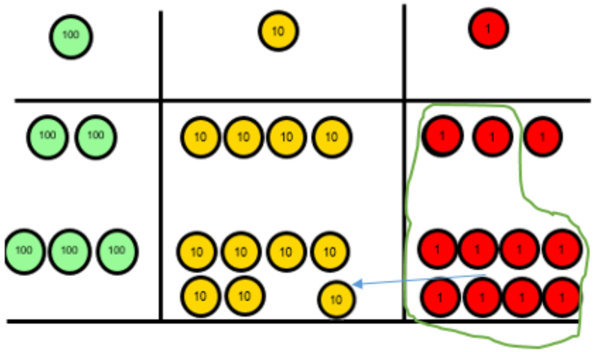
Addition-

Key language which should be used: sum, total, parts and wholes, plus, add, altogether, more than, 'is equal to' 'is the same as'

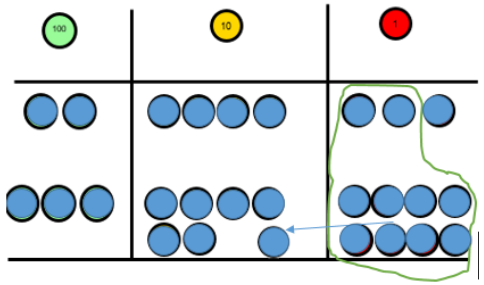
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears etc)  		4 + 3 = 7 (four is a part, 3 is a part and the whole is seven) 
Counting on using number lines by using cubes or numicon  	A bar model which encourages the children to count on 	The abstract number line: What is 2 more than 4? What is the sum of 4 and 4? What's the total of 4 and 2? 4 + 2 
Regrouping to make 10 by using ten frames and counters/cubes or using numicon: 6 + 5  	Children to draw the ten frame and counters/cubes 	Children to develop an understanding of equality e.g $6 + \square = 11$ and $6 + 5 = 5 + \square$ $6 + 5 = \square + 4$

TO + O using base 10. Continue to develop understanding of partitioning and place value 41 + 8 	Children to represent the concrete using a particular symbol e.g. lines for tens and dot/crosses for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49 $\begin{array}{r} 41 \\ +\ \ 8 \\ \hline 49 \end{array}$
TO + TO using base 10. Continue to develop understanding of partitioning and place value and use this to support addition. Begin with no exchanging. 36 + 25 	This could be done one of two ways:  	Looking for ways to make 10  30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 Formal method: $\begin{array}{r} 36 \\ +25 \\ \hline 61 \\ \hline 1 \end{array}$

Use of place value counters to add HTO + TO, HTO + HTO etc. once the children have had practice with this, they should be able to apply it to larger numbers and the abstract



Chidren to represent the counters e.g. like the image below

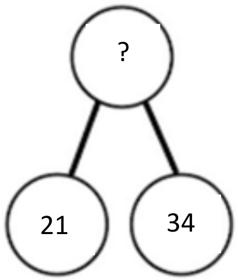


If the children are completing a word problem, draw a bar model to represent what it's asking them to do

?	
243	368

```
 243
+368
 611
 1 1
```

Fluency variation, different ways to ask children to solve 21+34:



?	
21	34

Sam saved £21 one week and £34 another. How much did he save in total?

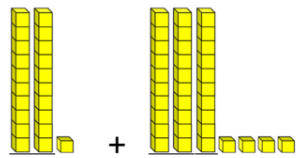
21+34=55. Prove it! (reasoning but the children need to be fluent in representing this)

```
 21
+34
———
```

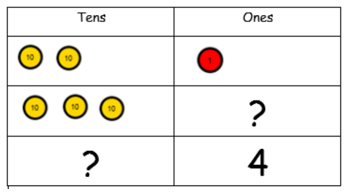
21 + 34 =

$\boxed{}$ = 21 + 34

What's the sum of twenty one and thirty four?

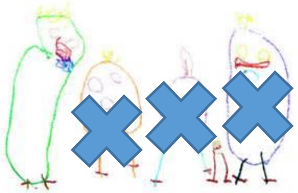
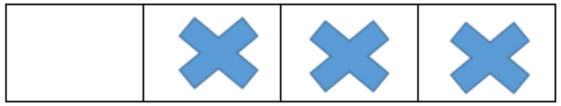
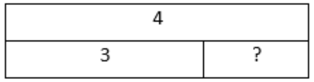
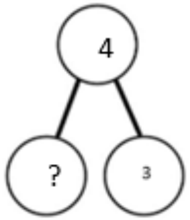
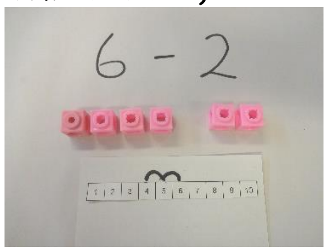
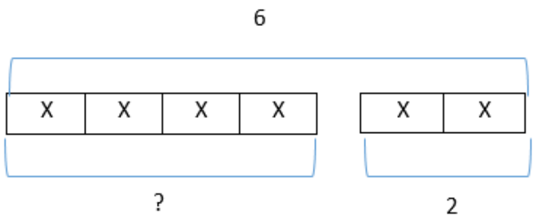
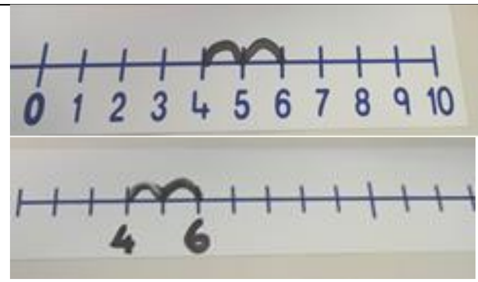


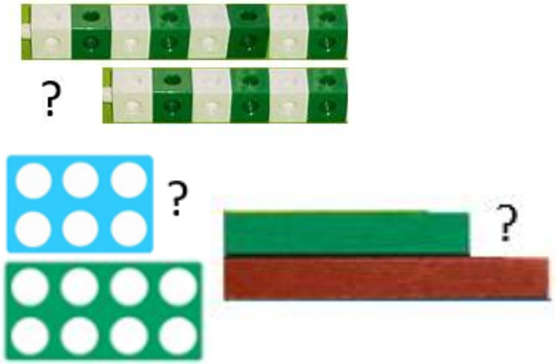
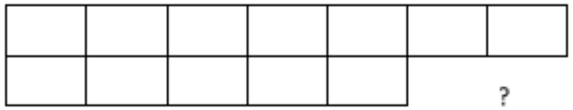
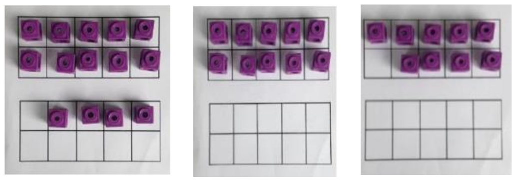
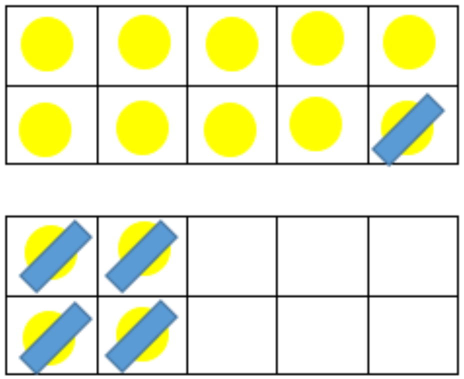
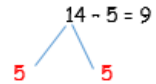
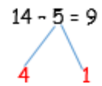
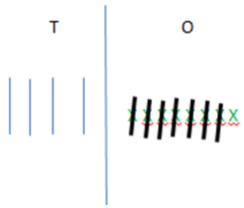
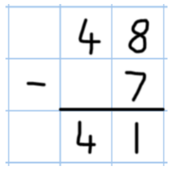
Always use missing digit problems too:



Subtraction-

Key language which should be used: take away, less than, the difference, subtract, minus, fewer, decrease, '7 take away 3, the difference is four'

Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (use various objects too) rather than crossing out- children will physically remove the objects $4 - 3 = 1$ 	Children to draw the concrete resources they are using and cross out.  Use of the bar model: 	**4- 3 =** $\boxed{}$ **= 4 - 3**  
Counting back (using number lines or number tracks)  	Children to represent what they see pictorially e.g.  	

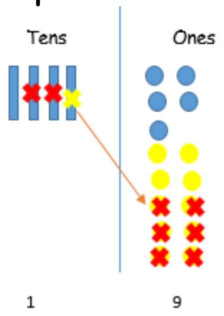
Finding the difference (using cubes, numicon or Cuisenaire rods, other objects can also be used)  	Children to draw the cubes/other concrete objects which they have used XXXXXXXX XXXXXX Use of the bar model  	Find the difference between 8 and 6. 8 – 6, the difference is ? Children to also explore why 9 - 7 = 8 – 6 (the difference, of each digit, has changed by 1 do the difference is the same- this will help when solving 10000-9987)
Making 10 (using numicon or ten frames) 14 – 5  Children could also do this by subtracting a 5 from the 10. 	Children to present the ten frame pictorially 	14 – 5 = 9 You also want children to see related facts e.g. 15 – 9 = 5 Children to represent how they have solved it e.g.  14 is made up of 5, 5 and 4 so I can subtract one 5 to be left with 4 and 5  5 is made up of 4 and 1 so I can subtract 4 to make 10 and then 1 to get to 9
Column method (using base 10) 48-7 	 	48 – 7 = 

Column method (using base 10 and having to exchange)

45-26

1) Start by partitioning 45
2) Exchange one ten for ten more ones
3) Subtract the ones, then the tens.

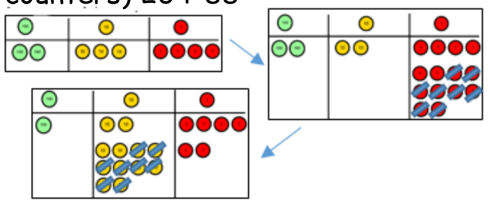
Represent the base 10 pictorially



It's crucial that the children understand that when they have exchanged the 10 they still have 45. 45 = 30 + 15

$$\begin{array}{r} {}^{3}\cancel{4}\;{}^{1}5 \\ -\;2\;6 \\ \hline 1\;9 \end{array}$$

Column method (using place value counters) 234-88

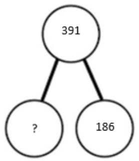


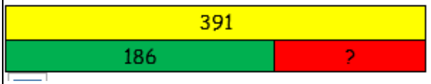
Once the children have had practice with the concrete, they should be able to apply it to any subtraction.

Like the other pictorial representations, children to represent the counters.

$$\begin{array}{r} 2\,{}^{2}\cancel{3}\,{}^{1}4 \\ -\;\;88 \\ \hline 6 \\ \hline \end{array}$$

Fluency variation, different ways to ask children to solve 391-186:





Raj spent £391, Timmy spent £186. How much more did Raj spend?

I had 391 metres to run. After 186 I stopped. How many metres do I have left to run?

391 - 186

$\square$ = 391 - 186

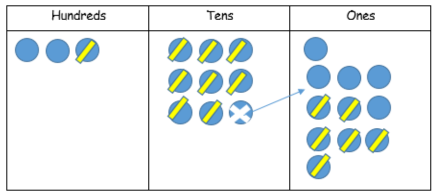
$$\begin{array}{r} 391 \\ -186 \\ \hline \\ \hline \end{array}$$

Find the difference ebtween 391 and 186

Subtract 186 from 391.

What is 186 less than 391?

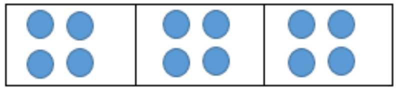
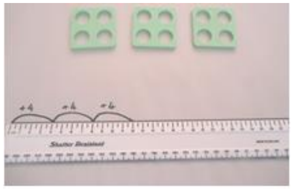
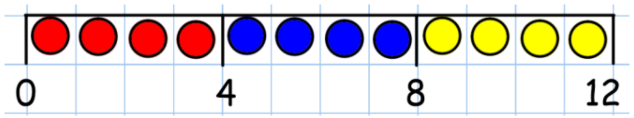
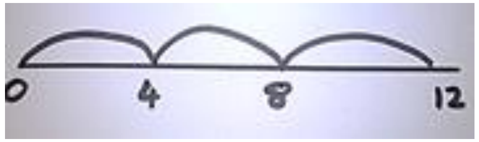
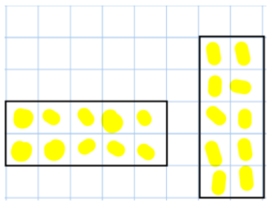
What's the calculation? What's the answer?

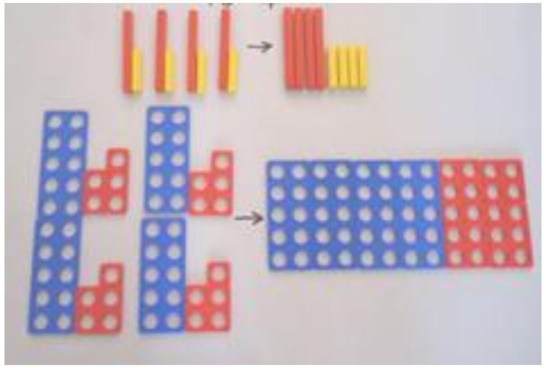
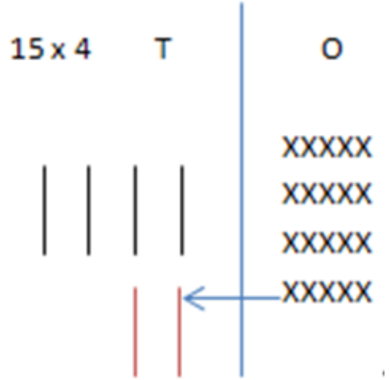
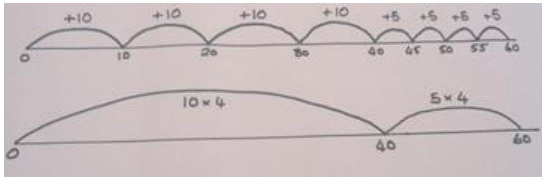
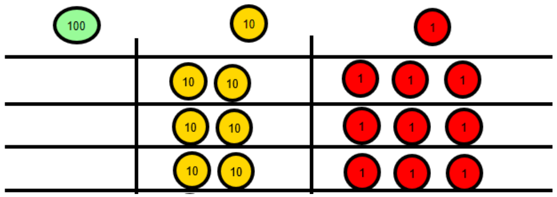
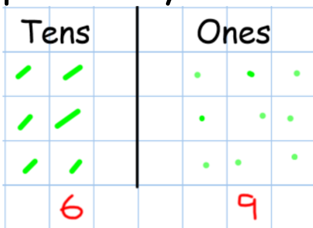


$$\begin{array}{r} 3\;9\;\square \\ -\;\square\;\square\;6 \\ \hline \square\;0\;5 \end{array}$$

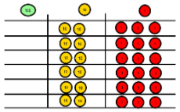
Multiplication-

Key language which should be used: double times, multiplied by, the product of, groups of, lots of, 'is equal to' 'is the same as'

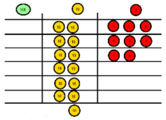
Concrete	Pictorial	Abstract
Repeated grouping/repeated addition (does not have to be restricted to cubes) 3 x 4 or 3 lots of 4 	Children to represent the practical resources in a picture e.g. XX XX XX XX XX XX Use of a bar model for a more structured method 	3 x 4 4 + 4 + 4
Use number lines to show repeated groups- 3 x 4 	Represent this pictorially alongside a number line e.g: 	Abstract number line **3 x 4 = 12** 
Use arrays to illustrate commutativity (counters and other objects can also be used) **2 x 5 = 5 x 2** 	Children to draw the arrays 	Children to be able to use an array to write a range of calculations e.g. 2 x 5 = 10 5 x 2 = 10 2 + 2 + 2 + 2 + 2 = 10 5 + 5 =10

Partition to multiply (use numicon, base 10, Cuisenaire rods) 4 x 15 	Children to represent the concrete manipulatives in a picture e.g. base 10 can be represented like: 	Children to be encouraged to show the steps they have taken 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used 
Formal column method with place value counters or base 10 (at the first stage- no exchanging) 3 x 23 Make 23, 3 times. See how many ones, then how many tens 	**Children to represent the counters in a pictorial way** 	Children to record what it is they are doing to show understanding 3 x 23 3 x 20 = 60 3 x 3 = 9 20 3 60 + 9= 69 $\begin{array}{r} 23 \\ \times\ 3 \\ \hline 69 \\ \hline \end{array}$
Formal column method with place value counters (children need this stage, initially, to understand how the column method works)	Children to represent the counters/base 10, pictorially e.g. the image below.	**6 x 23** 6 x 3 = 18 6 x 20 = 120 120 + 18 = 138

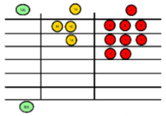
6 x 23



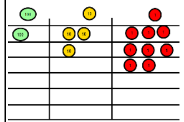
Step 1: get 6 lots of 23



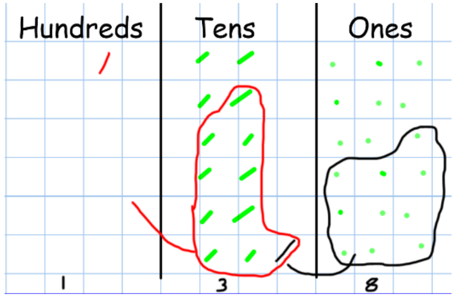
Step 2: 6 x 3 is 18. Can I make an exchange? Yes! Ten ones for one ten….



Step 3: 6 x 2 tens and my extra ten is 13 tens. Can I make an exchange? Yes! Ten tens for one hundred…



Step 4- what do I have I each column?



The aim is to get to the formal method but the children need to understand how it works.

6 x 23 =

$$\begin{array}{r} 23 \\ \times \quad 6 \\ \hline 138 \\ \hline {\scriptstyle 1\ 1\ \ } \end{array}$$

When children start to multiply 3d x 3d and 4d x 2d etc, they should be confident with the abstract:

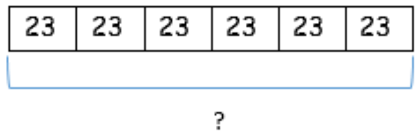
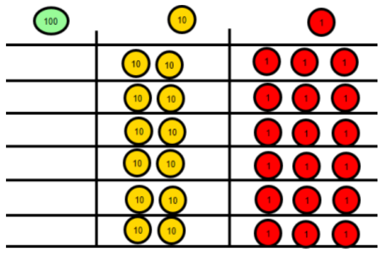
To get 744 children have solved 6 x 124

To get 2480 they have solved 20 x 124

$$\begin{array}{rrrr} & 1 & 2 & 4 \\ \times & & 2 & 6 \\ \hline & 7_{1} & 4_{2} & 4 \\ 2 & 4 & 8 & 0 \\ \hline 3 & 2 & 2 & 4 \\ \hline {\scriptstyle 1} & {\scriptstyle 1} & & \end{array}$$

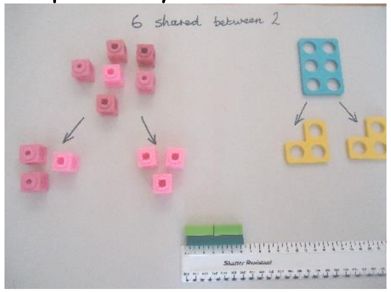
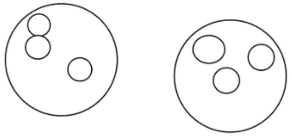
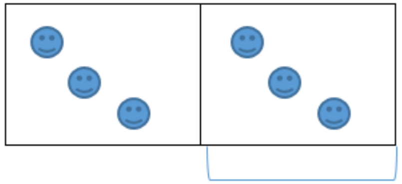
Answer: 3224

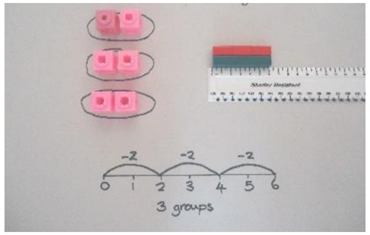
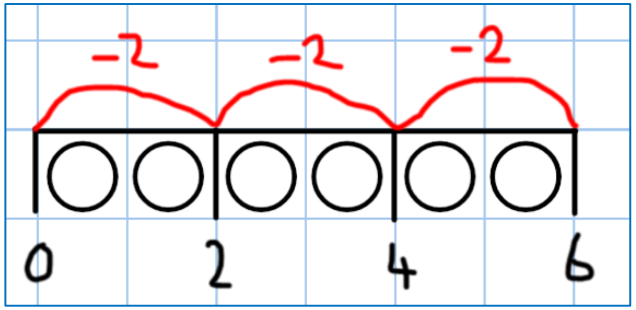
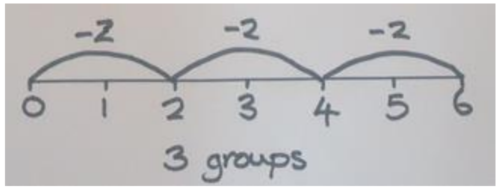
Fluency variation, different ways to ask children to solve 6 x 23:

 With the counters, prove that 6 x 23 = 138 Why is 6 x 23 = 32 x 6?	Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? Tom saved 23p three days a week. How much did he save in 2 weeks?	Find the product of 6 and 23 6 x 23 = $\boxed{}$ = 6 x 23 $\begin{array}{r} 6 \\ \times\ \underline{23} \\ \underline{} \end{array}$ $\begin{array}{r} 23 \\ \times\ \underline{\ 6} \\ \underline{} \end{array}$	What's the calculation? What's the answer? 

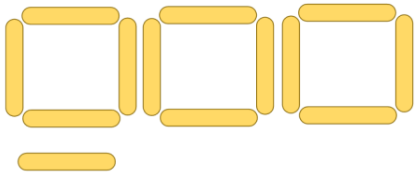
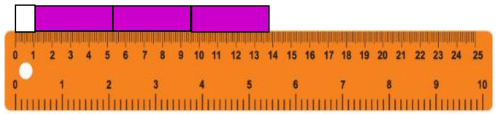
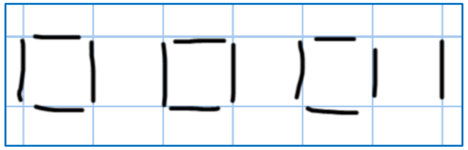
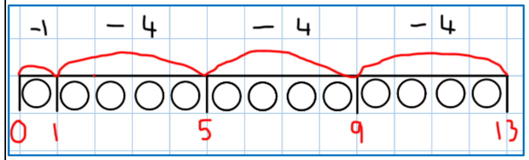
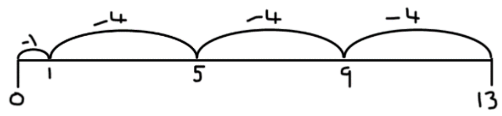
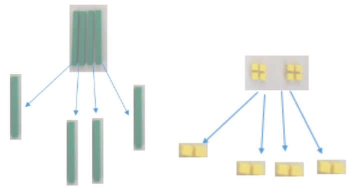
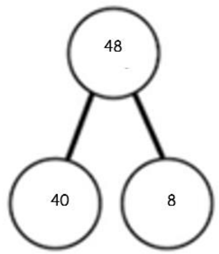
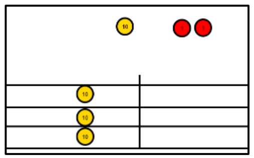
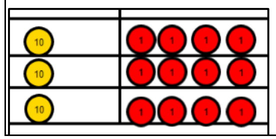
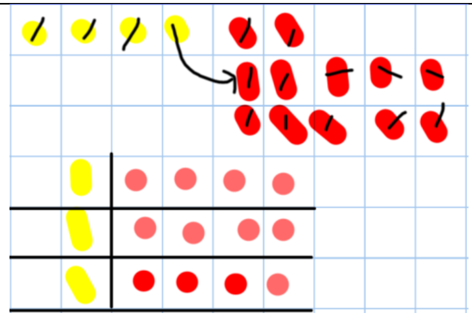
Division-

Key language which should be used: share, group, divide, divided by, half, 'is equal to' 'is the same as'

<table>
<tr><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>6 shared between 2 (other concrete objects can also be used e.g. children and hoops, teddy bears, cakes and plates)

</td>
<td>
This can also be done in a bar so all 4 operations have a similar structure:
</td>
<td>6 ÷ 2 = 3

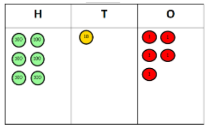
What's the calculation?
<table><tr><td>3</td><td>3</td></tr></table></td>
</tr>
<tr>
<td>Understand division as repeated grouping and subtracting
6 ÷ 2

</td>
<td>
</td>
<td>Abstract number line

</td>
</tr>
<tr>
<td>2d ÷ 1d with remainders
13 ÷ 4 – 3 remainder 1</td>
<td>Children to have chance to represent the resources they use in a pictorial way e.g. see below:</td>
<td>13 ÷ 4 – 3 remainder 1

Children to count their times tables facts in their heads</td>
</tr>
</table>

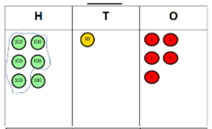
Use of lollipop sticks to form wholes  Use of Cuisenaire rods and rulers (using repeated subtraction) 	  	
2d divided by 1d using base 10 (no remainders) SHARING **48 ÷ 4 = 12**  Start with the tens.	Children to represent the base 10 and sharing pictorially.	48 ÷ 4  4 tens ÷ 4 = 1 ten 8 ones ÷ 4 = 2 ones 10 + 2 = 12
Sharing using place value counters. 42 ÷ 3= 14  1. Make 42. Share the 4 tens between 3. Can we make an exchange with the extra 10?  Exchange the ten for 10 ones and share out 12 ones		42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14

Use of the 'bus stop method' using grouping and counters. Key language for grouping- how many groups of X can we make with X hundreds'- ***this can also be done using sharing!***

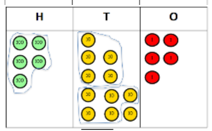
615 ÷ 5



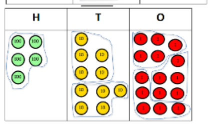
Step 1: make 615



Step 2: Circle your groups of 5



Step 3: Exchange 1H for 10T and circle groups of 5



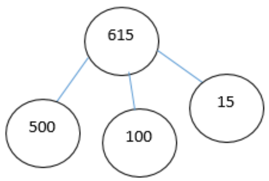
Step 4: exchange 1T for 10ones and circles groups of 5

This can easily be represented pictorially, till the children no longer to do it.
It can also be done to decimal places if you have a remainder!

$$5\,\overline{\smash{)}\,6^{1}1^{1}5}\quad = 123$$

Fluency variation, different ways to ask children to solve 615 ÷ 5:

Using the part whole model below, how can you divide 615 by 5 without using the 'bus stop' method?



I have £615 and share it equally between 5 bank accounts. How much will be in each account?

615 pupils need to be put into 5 groups. How many will be in each group?

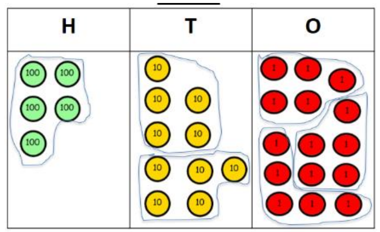
$5\,\overline{\smash{)}\,615}$

615 ÷ 5 =

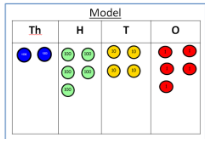
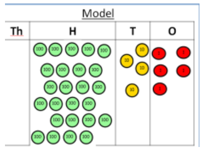
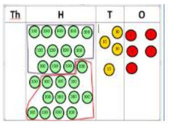
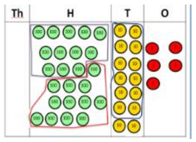
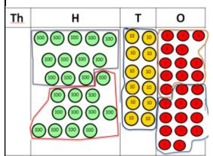
$\boxed{}$ = 615 ÷ 5

How many 5's go into 615?

What's the calculation? What's the answer?____



Long division

Concrete	Pictorial	Abstract
 0 2 1 2 12⟌2544 24 14 12 24 24 0 2544 ÷ 12 How many groups of 12 thousands do we have? None  Exchange 2 thousand for 20 hundreds.  0 2 12⟌2544 24 1 How many groups of 12 are in 25 hundreds? 2 groups. Circle them. We have grouped 24 hundreds so can take them off and we are left with one.  0 2 1 12⟌2544 24 14 12 2 Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2.  Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2	Children to represent the counters, pictorially and record the subtractions beneath.	0 12⟌2544 Step one- exchange 2 thousand for 20 hundreds so we now have 25 hundreds. 0 2 12⟌2544 24 1 Step two- How many groups of 12 can I make with 25 hundreds? The 24 shows the hundreds we have grouped. The one is how many hundreds we have left. 0 2 1 12⟌2544 24 14 12 2 Exchange the one hundred for 10 tens. How many groups of 12 can I make with 14 tens? The 14 shows how many tens I have, the 12 is how many I grouped and the 2 is how many tens I have left. 0 2 1 2 12⟌2544 24 14 12 24 24 0 Exchange the 2 tens for 20 ones. The 24 is how many ones I have grouped and the 0 is what I have left.