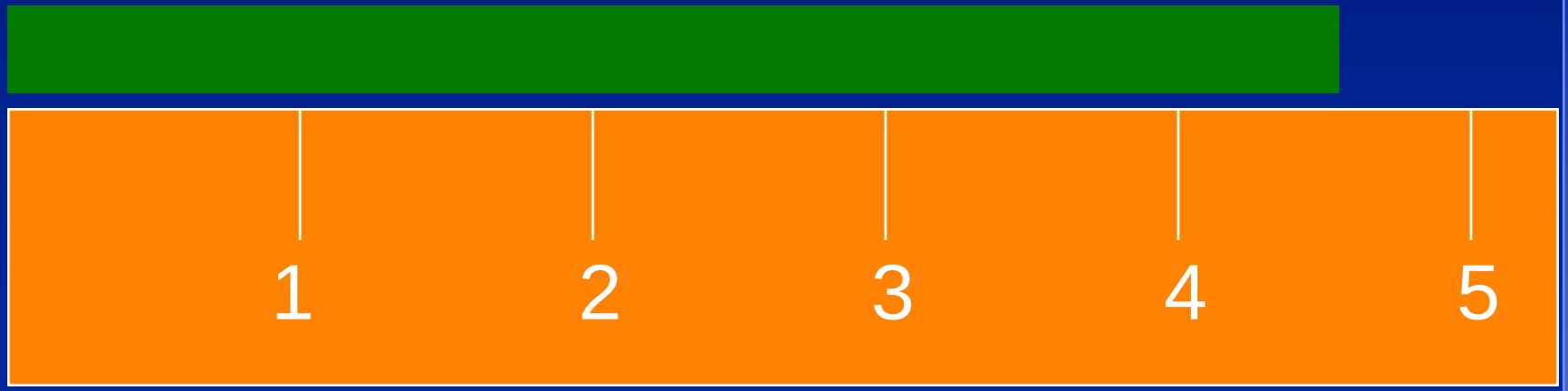
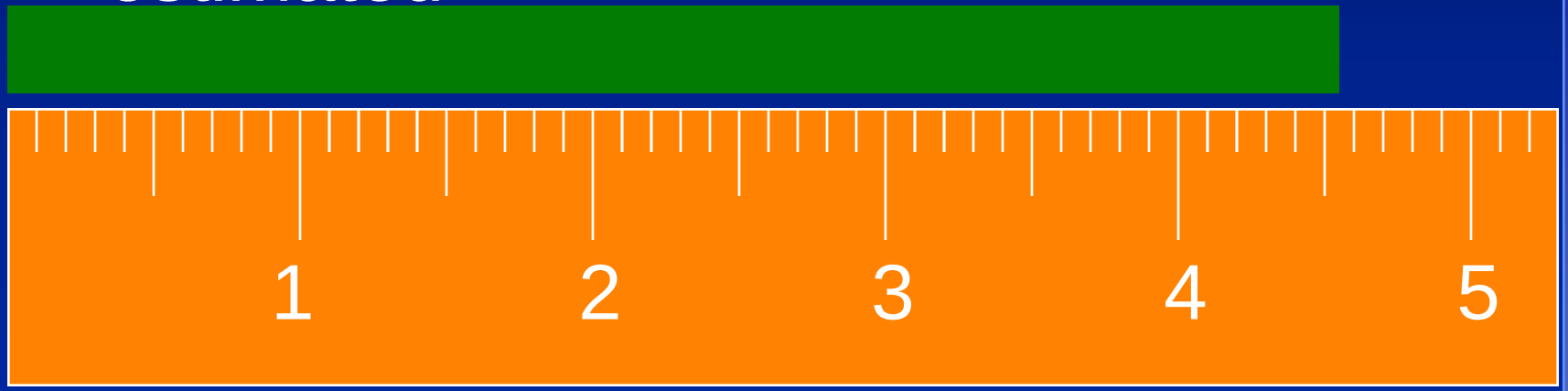
Significant figures (sig figs)

- How many numbers mean anything.
- When we measure something, we can (and do) always estimate between the smallest marks.



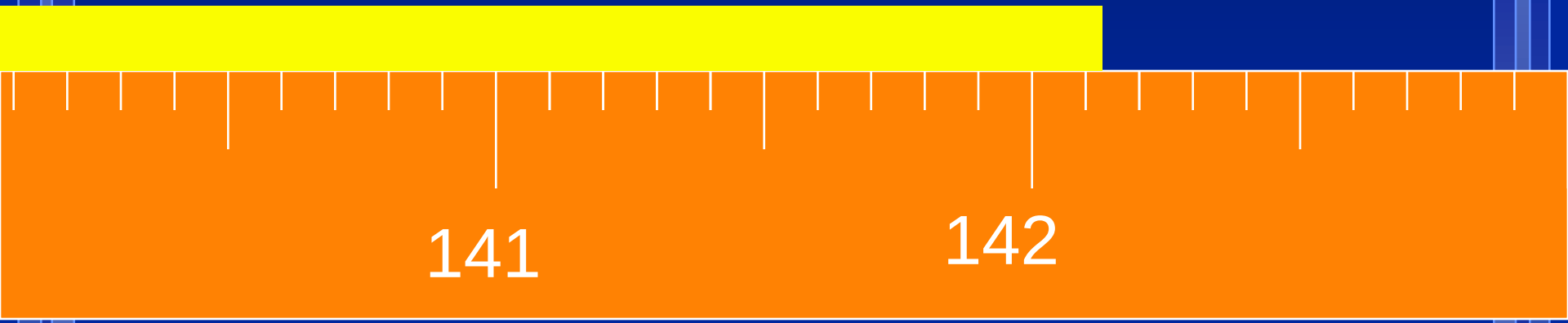
Significant figures (sig figs)

- The closer the marks the better we can estimate.
- ALL measurements contains digits that are known accurately plus one that is estimated



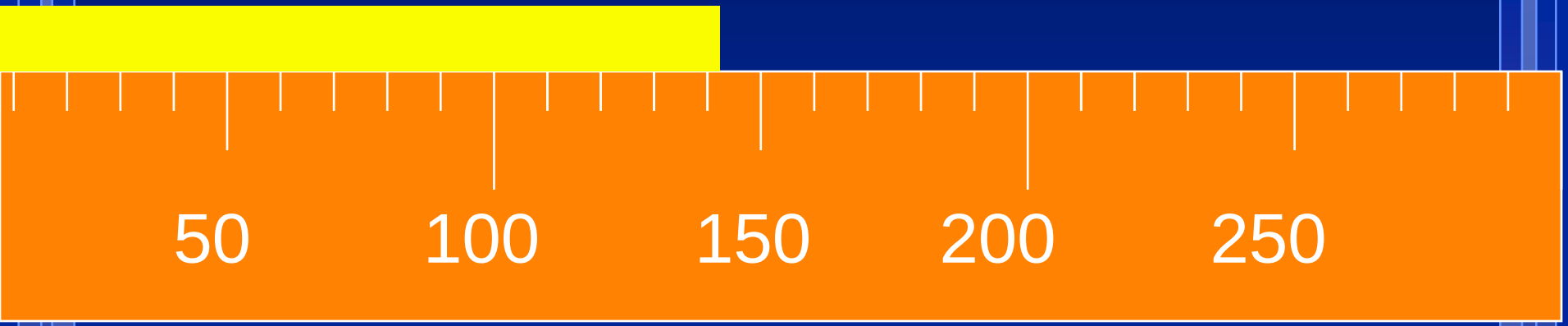
Significant figures (sig figs)

- The measurements we write down tell us about the ruler we measure with
- The last digit is between the lines
- What is the smallest mark on the ruler that measures 142.13 cm?



Significant figures (sig figs)

- What is the smallest mark on the ruler that measures 142 cm?



Significant Figures Rules

1. All non-zero numbers are significant.

Ex. 3256 36 52,236

ZEROS?

- 2. Captive - Zeros between non-zero numbers count.
- Ex. 102 30,001
- 3. Leaders - If the number is smaller than one, zeroes before the first number don’t count.
- 0.045 .0000029
- These zeros are only place holders

Zeros?

- 4. Trailing zeros – zeros at the end of a number
- Count as significant only if there is a decimal point.
- Ex. 240 240. 240.0
- Ex. 0.0600 4.30×10^6

Problem

- 50 is only 1 significant figure.
- if it really has two, how can I write it?
- Put in a decimal point 50. or use
- Scientific notation.
- 5.0×10^{1}
- now the zero counts.

Sig figs.

- How many sig figs in the following measurements?
- 458 g
- 4085 g
- 4850 g
- 0.0485 g
- 0.004085 g
- 40.004085 g
- 1234 g
- 0.023 g
- 890 g
- 91010 g
- 1090.0010 g

Rounding rules

- Look at the number behind the one you're rounding.
- If it is 0 to 4 don't change it.
- If it is 5 to 9 make it one bigger.
- Round 45.462 to four sig figs. 45.46
- to three sig figs. 45.5
- to two sig figs. 45
- to one sig figs. 50

Watch the Sig Figs

- When rounding, you don't change the size of the number.
- You should end up with a number about the same size.
- Use place holders- they're not significant.
  - Round 15253 to 3 sig figs 15300
  - Round 0.028965 to 3 sig figs 0.0290

Numbers without sig figs

- Counted numbers
  - 12 eggs in a dozen
  - 32 students in a class
- Definitions
  - 1 m = 100 cm
  - 16 ounces is 1 pound
- No estimated numbers
- Unlimited significant figures

Scientific notation

- All non-zero digits in scientific notation are significant figures.
- Any ending zero after the decimal point is significant
- 1.20×10^3
- Sometimes you must write in scientific notation to use the correct sig figs.

Adding and subtracting with sig figs

- The last sig fig in a measurement is an estimate.
- Your answer when you add or subtract can not be better than your worst estimate.
- Your answer can only have as many places to the right of the decimal as the measurement with the fewest to the right
- COUNT DECIMAL PLACES!!

For example

27.93 + 6.4

- First line up the decimal places

```
  27.93
+  6.4
------
  34.3
```

Then do the adding..

Find the estimated numbers in the problem.

This answer must be rounded to the tenths place.

Practice

- 16.53g + 981.1g + 4.193g
- 9.924m + 1.72m + 5.6322m
- 14.20 km – 1.00163 km

Multiplication and Division

- Rule is simpler
- Same number of sig figs in the answer as the least in the question
- COUNT SIGNIFICANT FIGURES!!
- 3.6 x 653
- = 2350.8
- 3.6 has 2 s.f. 653 has 3 s.f.
- answer can only have 2 s.f.
- 2400

Multiplication and Division

- Same rules for division.
- practice
- 3.33g x .011g
- 141.92m x 39.1m
- 0.3652 cm / 0.021 cm