Measurement Lesson 2

Learning Goal 6: I can explain the importance of significant figures in a measurement and identify the number of significant figures in a measurement value.

Learning Goal 7: I can round calculated values to the correct number of significant figures.

Learning Goal 8L: I can measure to the correct number of significant figures.

Ask your teacher for the handout that accompanies this lesson. You will also need a copy of a paper titled "Task Card Answer Sheet".

Part 1: Counting Significant Figures

Look at the handout titled "Significant Figures".

This handout shows six groups of measurements. For each group, the number of significant figures is indicated.

Analyze the data on the handout to determine when zero and nonzero digits are counted as significant figures.

? When are nonzero digits counted as significant figures?

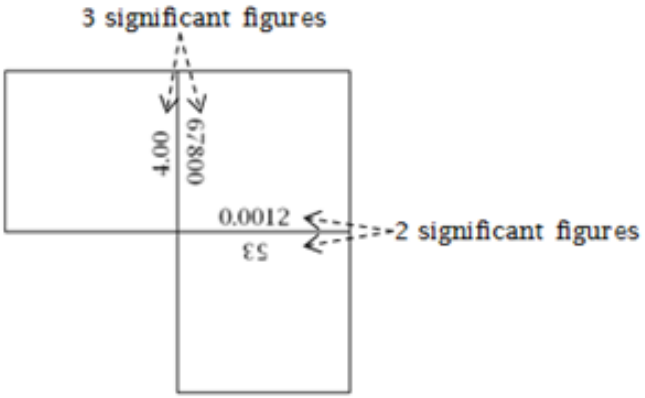
? When are zero digits counted as significant figures?
(Hint! There are <u>two</u> answers to this question.)

? When are zero digits NOT counted as significant figures?
(Hint! There are <u>two</u> answers to this question.)

Ask your teacher for an envelope containing a "Significant Figure Puzzle".

The puzzle has twelve square cards with numbers written on the sides of the squares.

Assemble the cards in a 3 x 4 grid so that the numbers that are touching one another have the same number of significant figures.



Part 2: Rounding Numbers

Compare the two groups of numbers below.

Both groups show numbers that have been rounded to a certain number of significant figures.

Group 1
Rounding to the <u>right</u> of the decimal point:

Round to 4 sig fig: 4.67391 ⟶ 4.674
Round to 3 sig fig: 4.67391 ⟶ 4.67
Round to 2 sig fig: 4.67391 ⟶ 4.7

Group 2
Rounding to the <u>left</u> of the decimal point:

Remove decimal and #'s to right of decimal — **Change unneeded digits to 0's**

Round to 4 sig fig: 56486.54 → 56486 → 56490
Round to 3 sig fig: 56486.54 → 56486 → 56500
Round to 2 sig fig: 56486.54 → 58486 → 56000

? Describe how to round a number when the number of significant figures needed ends to the <u>right of the decimal point</u>.

? Describe how to round a number when the number of significant figures needed ends to the <u>left of the decimal point</u>.

Get out the "Measurement – Set 2 Task Card Answer Sheet".

These task cards show different numbers next to different colors. Each person in a group should round numbers next to a **different color**.

Record your answers on the "Set Task Card Answer Sheet"

Part 3: Calculations

Compare the following rules for rounding the answers to calculations .

The answers to calculations involving measurements must be rounded so that they reflect the smallest degree of precision used in the measurement.

Rule 1
Multiplication and Division

Round answer to the smallest number of significant figures used in the calculation.

Ex. 4.32 x 7.301 = 31.54032
3sf 4sf 7sf

Lowest # of sig. fig. used

Round answer to : 31.5
3sf

*sf = significant figures

Rule 2
Addition and Subtraction

Round answer to the smallest number of decimal places used in the calculation.

Ex. 3.678 + 2.12 = 5.789
3dp 2 dp 3dp

Lowest # of dec. places. used

Round answer to : 5.79
2dp

*dp = decimal places

? What is the main rounding difference between the two rules?

Ask your teacher for a set of "Measurement – Set 3 Task Cards" and get out the "Task Card Answer Sheet".

? Answer the questions on the task cards. Use the rules from about to round each answer to the correct number of digits.

Task Card Answer Sheet

Measurement Set 2 Task Cards

Color_____

1	2	3	4
5	6	7	8
9	10	11	12

Measurement Set 3 Task Cards

Color_____

1	2	3	4
5	6	7	8

Significant Figures
Study Sheet

Identifying Significant Figures

Significant	NOT Significant
All nonzero numbers (1, 2, 3, 4, 5, 6, 7, 8, 9) 0's in between digits (3201) Trailing 0's with a decimal (45.300)	Leading 0's (0.00023) Trailing 0's without a decimal (743000)

Rounding

To the right of the decimal

Round to 3 sig figs: 67.3735

↓

Remove unneeded digits.

67.3735 = 67.3

↓

Round up if necessary.

67.3 = 67.4

To the left of the decimal

Round to 2 sig figs: 83452

↓

Change to scientific notation.

83452 = 8.3452×10^4

↓

Remove unneeded digits.

$8.3452 \times 10^4 = 8.3 \times 10^4$

↓

Round up if necessary.

Not necessary

Calculations

Rule 1
Multiplication and Division

Round answer to the smallest number of significant figures used in the calculation.

Ex. 4.32 x 7.301 = 31.54032
3sf 4sf 7sf

Lowest # of sig. fig. used

Round answer to : 31.5
3sf

*sf = significant figures

Rule 2
Addition and Subtraction

Round answer to the smallest number of decimal places used in the calculation.

Ex. 3.678 + 2.12 = 5.789
3dp 2 dp 3dp

Lowest # of dec. places. used

Round answer to : 5.79
2dp

*dp = decimal places

Significant Figures

1 Significant Figure

4

400

4.

0.004

4×10^3

2 Significant Figures

45

450

4.5

0.0045

4.5×10^3

3 Significant Figures

453

45300

4.53

0.00453

4.53×10^3

403

4 Significant Figures

4537

453700

4.537

0.004537

4.537×10^3

4007

5 Significant Figures

45372

4537200

4.5372

0.0045372

4.5372×10^3

40002

6 Significant Figures

453726

45372600

4.53726

0.00453726

4.53726×10^3

400006

101	70072	1010
39100	42	0.0023
3.00×10^3		
456	8.2201	0.00476
10000	0.09361	2.003×10^3
80.08	0.00478	590021
2		
1.234	2.11×10^5	0.0852143
97310	0.00007	300
10000000	550	0.0053
5.670		
0.007	4.1	280
5	0.005681	4041
4000		

0.005 3 70000000	6.412 86210 760	3.33×10^{5} 0.00009 3.370	0.0641296 700 0.0026
612 10000 70.00	94201 0.05219 5 0.00942	0.00945 1.003×10^{3} 690077	280 7051
701 48200	50012 21 5.00×10^{3}	8020 0.0067	3.2 0.009442 2000

101 52100 4.00×10^3 93 70072	0.0098 1010	
259 70000 80.00	2.2301 0.03261 9 0.00478	0.00796 7.003×10^3 590021
4.254 73210 90000000	4.21×10^5 0.00003 6.269 830	0.0256143 006 0.0064
0.008 2 0006	7.4 0.003961 0064	740 2064

0.0012 4020	72 8.00×10^3 10082	67100 901
0.00523 6.003×10^3 610076	5.1301 0.03651 7 0.00395	762 50000 40.00
0.0152853 200 0.0023	7.85×10^5 0.00002 2.170 640	9.434 88310 80000000
310 3021	2.4 0.003281 7000	0.002 6

0.008 8	6.2 0.004987 0008	840 7054
20000000 62310	230 0.00003 6.270	0.0043 700
8.573 20.00	5.41×10^{5} 0.00654	0.0931143 430021
974 70000	6.3801 0.04321 4	0.00546 3.009×10^{3}
401 54300	30032 13 4.00×10^{3}	9060 0.0056

0.003 6	7.6 0.002667 4000	560 9041
30000000 69810 9.539	610 0.00003 5.670 9.64×10^{5}	0.0084 100 0.0742963
50.00 90000 912	0.00632 0.08261 4 9.6501	790023 4.003×10^{3} 0.00643
308 72100	20032 62 5.00×10^{3}	5080 0.0031

Significant Figures in Calculations - Answers

By the end of this lesson, I will be able to:

- ✓ Identify the number of significant figures in a measurement.
- ✓ Explain the difference between rounding to the right of a decimal and rounding to the left of a decimal.
- ✓ Contrast how to round the answer to a multiplication or division calculation with how to round the answer to an addition or subtraction calculation.
- ✓ Perform simple calculations and round the answers to the correct number of digits.

✋ *Ask your teacher for the handout that accompanies this lesson. You will also need a copy of a paper titled "Task Card Answer Sheet".*

Part 1: Counting Significant Figures

👁 *Look at the handout titled "Significant Figures".*

This handout shows five groups of measurements. For each group, the number of significant figures is indicated.

👁 Analyze the data on the handout to determine when zero and nonzero digits are counted as significant figures.

? When are nonzero digits counted as significant figures?

> Nonzero digits are always counted as significant figures.

? When are zero digits counted as significant figures? (Hint! There are <u>two</u> answers to this question.)

> Zero digits are counted as significant figures when they are in between other digits AND when they are trailing zeroes **<u>in a decimal</u>**.

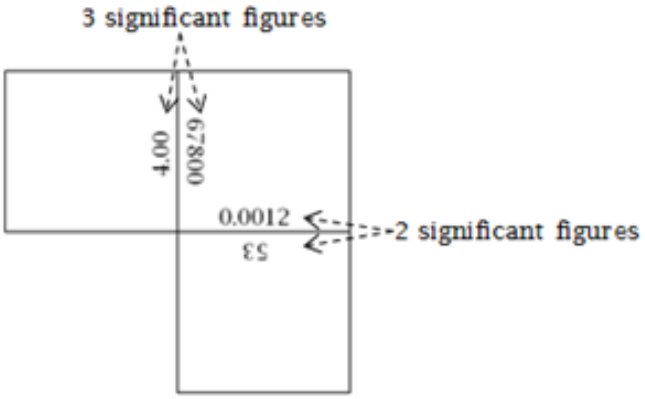
? When are zero digits NOT counted as significant figures? (Hint! There are <u>two</u> answers to this question.)

> Zero digits are note counted as significant figures when they are leading zeroes AND when they are trailing zeroes **<u>in a nondecimal</u>**.

Ask your teacher for an envelope containing a "Significant Figure Puzzle" and get out the "Task Card Answer Sheet".

The puzzle has twelve square cards with numbers written on the sides of the squares.

- Assemble the cards in a 3 x 4 grid so that the numbers that are touching one another have the same number of significant figures.



? Record your card arrangement on the "Task Card Answer Sheet" by copying the cards onto the grid. Be sure to also record the color of the cards.

Part 2: Rounding Numbers

Compare the two groups of numbers below.

Both groups show numbers that have been rounded to a certain number of significant figures.

Group 1
Rounding to the <u>right</u> of the decimal point:

Round to 4 sig fig: $4.67391 \longrightarrow 4.674$
Round to 3 sig fig: $4.67391 \longrightarrow 4.67$
Round to 2 sig fig: $4.67391 \longrightarrow 4.7$

Group 2
Rounding to the <u>left</u> of the decimal point:

Change to scientific notation!

Round to 4 sig fig: $56486.54 \longrightarrow 5.648654 \times 10^4 \longrightarrow 5.649 \times 10^4$
Round to 3 sig fig: $56486.54 \longrightarrow 5.648654 \times 10^4 \longrightarrow 5.65 \times 10^4$
Round to 2 sig fig: $56486.54 \longrightarrow 5.648654 \times 10^4 \longrightarrow 5.6 \times 10^4$

? Describe how to round a number when the number of significant figures needed ends to the right of the decimal point.

Remove digits from the right of the number. Round the last digit up if the last digit removed is greater than or equal to five.

? Describe how to round a number when the number of significant figures needed ends to the left of the decimal point.

Change the number to scientific notation. Remove digits from the right of the number. Round the last digit up if the last digit removed is greater than or equal to five.

✋ *Return to your "Task Card Answer Sheet".*

Your teacher has hidden Rounding Task Cards around the room. Each task card has six colors next to six questions. Each question asks you to round a number to a certain number of significant figures.

✋ Find each task card and answer the question next the color that was on your "Significant Figure Puzzle" in Part 1.

? Record your answers on your "Task Card Answer Sheet".

Part 3: Calculations

👁 *Compare the following rules for rounding the answers to calculations .*

The answers to calculations involving measurements must be rounded so that they reflect the smallest degree of precision used in the measurement.

Rule 1
Multiplication and Division

Round answer to the smallest number of significant figures used in the calculation.

Ex. 4.32 x 7.301 = 31.54032
3sf 4sf 7sf

Lowest # of sig. fig. used

Round answer to : 31.5
3sf

*sf = significant figures

Rule 2
Addition and Subtraction

Round answer to the smallest number of decimal places used in the calculation.

Ex. 3.678 + 2.12 = 5.789
3dp 2 dp 3dp

Lowest # of dec. places. used

Round answer to : 5.79
2dp

*dp = decimal places

? What is the main rounding difference between the two rules?

In multiplication and division, the answer should be rounded to the lowest number of significant figures used. In addition and subtraction, the answer should be rounded to the lowest number of decimal places used.

Ask your teacher for a set of "Calculation Task Cards" and get out the "Task Card Answer Sheet".

? Perform the calculations on the Calculation Task Cards. Use the rules from above to round each answer to the correct number of digits. **Record your answers on your "Task Card Answer Sheet".**

Task Card Answers

Puzzle Answers

See the arrangement of the cards before cutting.

Rounding Answers

Card	Red	Orange	Yellow	Green	Blue	Violet
1	3.460	9.071	23.61	496.4	92.74	561.9
2	4.3×10^4	8.9×10^2	7.2×10^3	9.7×10^5	6.9×10^4	1.5×10^4
3	6.9×10^3	3.2×10^4	6.9×10^7	2.7×10^2	9.3×10^8	4.2×10^5
4	2.85	9.12	1.38	8.57	4.08	5.23
5	8×10^3 (8000)	10×10^4 (1.0×10^5) (100000)	2×10^5 (200000)	9×10^4 (90000)	6×10^3 (6000)	4×10^4 (40000)
6	7.92×10^5	4.79×10^3	2.46×10^4	8.77×10^2	6.53×10^7	3.92×10^8
7	4.3197×10^7	7.0347×10^6	5.3279×10^5	2.8535×10^6	3.7655×10^5	6.8457×10^7
8	5.8	4.5	9.4	3.6	2.8	1.4
9	6.72×10^5	4.33×10^4	2.13×10^4	8.30×10^4	3.97×10^5	5.83×10^4
10	6.128×10^5	8.330×10^2	3.426×10^7	2.483×10^3	4.284×10^9	5.846×10^6
11	8.9×10^2	5.1×10^3	24 (2.4×10^1)	67 (6.7×10^1)	7.8×10^2	4.5×10^3
12	1.644×10^5	9.309×10^6	5.973×10^5	2.873×10^5	4.733×10^6	3.747×10^5

Calculation Answers

Card	Red	Orange	Yellow	Green	Blue	Violet
1	6.1×10^1 (61)	4.7×10^1 (47)	5.4×10^1 (54)	4.1×10^1 (41)	2.6×10^1 (26)	7.1×10^1 (71)
2	14.2	16.2	18.2	13.1	13.2	17.2
3	14.5	19.9	8.01	11.7	18.2	13.9
4	32	25	32	27	54	18
5	4.1×10^3	3.4×10^4	4.4×10^5	1.8×10^4	2.1×10^3	2.2×10^4
6	3.91	3.88	1.37	1.92	3.01	3.23
7	1.64	2.19	2.73	3.50	1.63	1.32
8	5.813	8.629	11.809	14.704	10.840	12.606

Terms of Use

Thank you for your purchase! By purchasing this resource, you are agreeing that the contents are the property of Shari Kendrick and **licensed to you only for classroom/personal use as a single user**. I retain the copyright, and reserve all rights to this product.

YOU MAY:

- ★ Use items (free and purchased) for your own classroom students, or your own personal use.
- ★ Reference this product in blog posts, at seminars, professional development workshops, or other such venues PROVIDED there is both credit given to myself as the author and a link back to my TPT store is included in your post/presentation.
- ★ Distribute and make copies of **free items only** to other teachers PROVIDED there is credit given to Shari Kendrick and a link back to my TPT store.

YOU MAY NOT:

- ★ Claim this work as your own, alter the files in any way, or remove/attempt to remove the copyright/watermarks.
- ★ Sell the files or combine them into another unit for sale/free.
- ★ Post this document for sale/free elsewhere on the internet. This includes Google Doc links on blogs and public classroom websites.
- ★ Make copies of purchased items to share with others is strictly forbidden and is a violation of the Terms of Use, along with copyright law.
- ★ Obtain this product through any of the channels listed above.

Thank you for abiding by universally accepted codes of professional ethics while using this product.

If you encounter an issue with your file, notice an error, or are in any way experiencing a problem, please contact me and I will be more than happy to help sort it out!

Credits

Thank you to all of the amazing artists who created the beautiful design elements in my cover page, previews, and task cards.

Cover Outside Border Graphic

Julie Faulkner
www.teacherspayteachers.com/Store/Julie-Faulkner

Preview Border Graphic

Lisa Tarman
www.teacherspayteachers.com/Store/Lisa-Tarman

Task Card Templates

Task card templates by Rebecca Bishop,
Delightful Daily Deals TPT Store ©
www.teacherspayteachers.com/Store/Delightful-Daily-Deals

Click here to learn how to earn credit toward your next TPT purchase.

Be the first to know about new products, freebies, and updates:

Follow my TPT Store

Follow my Pinterest Chemistry Site