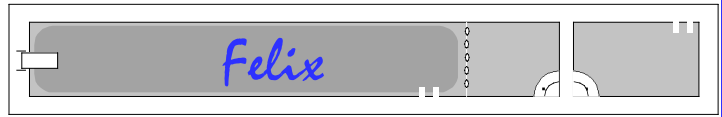


PHYZ SPRINGBOARD: VALUE JUDGMENTS



SIGNIFICANT FIGURES

1. A physics student named Miranda worked out a problem as shown below.

$$7.8 \text{ m} \div 3.4 \text{ s} = 2.29411764705882 \text{ m/s}$$

Miranda's lab partner, Esperanza, worked the problem out as shown below.

$$7.8 \text{ m} \div 3.4 \text{ s} = 2.3 \text{ m/s}$$

a. Why did Miranda think her own answer was better than Esperanza's?

Esperanza's answer is less precise/Miranda's answer is more precise.

b. When the papers were graded, Esperanza was given full credit and Miranda was given partial credit. Why did Esperanza get a better score on her calculation?

Esperanza's answer had the correct number of significant figures; the precision of her answer matched the precision of the numbers in the problem.

2. a. Consider the values listed to the right. _____ 7800 m _____ 0.0078 m

$$7.8 \times 10^3 \text{ m}$$

$$7.8 \times 10^{-3} \text{ m}$$

Select the statement that best characterizes these values.

____ These values have the **same** number of significant figures.

____ These values have **different** numbers of significant figures.

If you selected "same," explain your reasoning in the space below. If you selected "different," write the number of sig figs for each value in the small blank preceding the value.

The 7 and 8 in each value are significant; the zeros are not significant.

b. In the space below each value, rewrite the value using scientific notation. Which—if either—of these values has the greater number of sig figs?

3. The number of significant figures to which the values shown in the first two tables below is identified. Complete the third table.

Value	<u>sig</u> <u>fig</u> <u>s</u>
5,240,000	3
524	
5.24	
0.524	
0.000524	
5.24E-4	

Value	<u>sig</u> <u>fig</u> <u>s</u>
52,400	3
52,400.0	6
52,400.	5
5.240E+4	4
5.24E+4	3
52,401	5

Value	<u>sig</u> <u>fig</u> <u>s</u>
52.4	3
52.400	5
5,240	3
5,420.	4
1.000524	7
52,400,100	6

4. What is the title of this section? (Fill in the blanks at the top of the section.)

5. Consider the value **59,723.5146**. Write this value with the number of significant figures indicated.

a. One.

60,000

b. Four.

59,720

c. Twelve.

Cannot be done

ACCEPTABLE "PAPER AND PENCIL" USE / CORRECT LABORATORY USE

6. a. How many significant figures are acceptable in "paper and pencil" exercises? **2 or 3**

b. Select the correct answer.

i. $100 \text{ m} / 14 \text{ s} = \underline{\hspace{1cm}} 7.1 \text{ m/s}$ or $\underline{\hspace{1cm}} 7.142857143 \text{ m/s}$

ii. $3 \text{ kg} \cdot 6 \text{ m/s} = \underline{\hspace{1cm}} 20 \text{ kg}\cdot\text{m/s}$ or $\underline{\hspace{1cm}} 18 \text{ kg}\cdot\text{m/s}$

iii. $13.4 \text{ m/s} \cdot 27.8 \text{ s} = \underline{\hspace{1cm}} 372.52 \text{ m}$ or $\underline{\hspace{1cm}} 373 \text{ m}$

c. Solve these problems, showing acceptable "paper and pencil" use of significant figures.

i. $180 \text{ C} / 27 \text{ s}$ **6.7 C/s or 6.67 C/s**

ii. $2.3 \text{ cm} \cdot 5.7 \text{ cm}$ **13 cm² or 13.1 cm²**

7. When making calculations in laboratory work, it is important to use the correct number of significant figures to express measured and calculated results.

a. Select the correct answer.

i. $10.30 \text{ cm} / 4.2571 \text{ s} = \underline{\hspace{1cm}} 2.42 \text{ cm/s}$ or $\underline{\hspace{1cm}} 2.419 \text{ cm/s}$ or $\underline{\hspace{1cm}} 2.4195 \text{ cm/s}$

ii. $0.24 \text{ A} \cdot 3.56 \text{ V} = \underline{\hspace{1cm}} 0.9 \text{ W}$ or $\underline{\hspace{1cm}} 0.85 \text{ W}$ or $\underline{\hspace{1cm}} 0.854 \text{ W}$ or $\underline{\hspace{1cm}} 0.8544 \text{ W}$

Note: **The calculated value must have no more significant figures than the least precise measurement.**

b. Solve these problems, showing correct "laboratory" use of significant figures.

i. $2.6 \text{ N} \cdot 0.4352 \text{ m}$ **1.1 N·m**

ii. $8.7 \text{ N} / 0.23 \text{ m}$ **37 N/m**

COUNTING NUMBERS (EXACT VALUES)

8. Lab groups are given a supply of eight marbles and asked to determine the average mass of a marble. One group measures the mass of all eight marbles at once and divides that number by eight. The students within the group are divided as to how to express their answer. The total mass of the marbles is 167.83 g.

a. Sheila suggests they record their result as 20.97875 g. What was her reasoning?

Sheila gave the answer displayed on her calculator.

b. Alicia suggests they record their result as 20.979 g. What was her reasoning?

Alicia's answer has the same number of sig figs as the mass measurement.

c. Justin suggests they record their result as 20 g. What was his reasoning?

Justin's answer has the same number of sig figs as in the number of marbles.

d. Billy suggests they record their result as 20.98 g. What was his reasoning?

Billy's answer goes to the same decimal place as the mass measurement.

e. Who is correct and why?

Alicia! The number of marbles is a "counting number," not a measurement. There is no uncertainty involved in "counting numbers;" they are exact!