

Name Key Period _____ Date 10/13

ACCURACY AND PRECISION

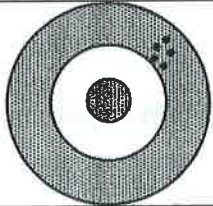
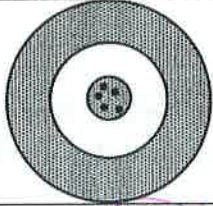
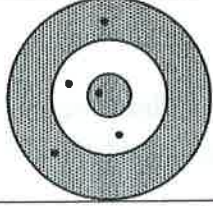
Definitions:

Accuracy - how close a measurement is to true value

Precision - how close a measurement is to itself (repeated)

Precision versus Accuracy:

Look at each target and decide whether the "hits" are accurate, precise, both accurate and precise, or neither accurate nor precise: (Note: An accurate "hit" is a bulls eye!)

		
Accurate?: Yes / <u>No</u> Precise?: <u>Yes</u> / No	Accurate?: <u>Yes</u> / No Precise?: <u>Yes</u> / No	Accurate?: Yes / <u>No</u> Precise?: Yes / <u>No</u>

Precision Problems:

A group of students worked in separate teams to measure the length of an object. Here are their data:

Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7
2.65 cm	2.75 cm	2.80 cm	2.77 cm	2.60 cm	2.65 cm	2.68 cm

- The average length is 2.7 cm.
This is the mean or average.
- Subtract the highest value from the lowest value: 0.20 cm. ($2.80 - 2.60$)
This is the range or spread.
- Divide this number by 2: 0.10 cm.
This is the approximate \pm range from the average.
- The precision of the measurement can be shown as average \pm range.
The precision of the measurement was 2.7 \pm 0.1 cm.

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Percent Error Practice Problems

- Show all work, including a formula and correct units after EVERY number on EVERY problem, or you will not receive credit for that problem

- 1) A student estimated a mass to be 250g, but upon carefully measuring it, found the actual mass to be 240g. What is the percent error?

$$\left| \frac{240 - 250}{240} \right| = \boxed{4.2\%}$$

- 2) A student measured the temperature of boiling water and got an experimental reading of 97.5°C. What is the percent error?

$$\left| \frac{100 - 97.5}{100} \right| \times 100 = \boxed{2.5\%}$$

- 3) An experimental measurement was taken of 10.4 mL and the actual measurement was 9.7 mL. What is the percent error?

$$\left| \frac{9.7 - 10.4}{9.7} \right| \times 100 = \boxed{7.2\%}$$

- 4) The experimental calculation of the specific heat of aluminum was found to be .156 cal/g°C, but the actual value was given as .185 cal/g°C. What is the percent error?

$$\left| \frac{0.185 - 0.156}{0.185} \right| \times 100 = \boxed{15.7\%}$$

- 5) Experimental = 62.5 g and accepted value = 65.2 g. Solve for percent error.

$$\left| \frac{65.2 - 62.5}{65.2} \right| \times 100 = \boxed{4.1\%}$$

Key.

1. Convert 1750 ml to liters.

$$\frac{1750 \text{ ml}}{1} \times \frac{1 \text{ L}}{1000 \text{ ml}}$$

Check

Show me the correct answer

Show me the solution

$$= \boxed{1.750 \text{ L}}$$

2. Convert 2 1/2 liters to cc's.

$$\frac{2.5 \text{ L}}{1} \times \frac{1000 \text{ ml}}{1 \text{ L}} = \boxed{\begin{matrix} 2500 \\ \text{ml} \\ \text{or} \\ \text{cc} \end{matrix}}$$

Check

Show me the correct answer

Show me the solution

3. Convert 0.75 g to mg.

$$\frac{0.75 \text{ g}}{1} \times \frac{1000 \text{ mg}}{1 \text{ g}} = \boxed{750 \text{ mg.}}$$

Check

Show me the correct answer

Show me the solution

4. Convert 250 mg to g.

$$\frac{250 \text{ mg}}{1} \times \frac{1 \text{ g}}{1000 \text{ mg}} = \boxed{0.250 \text{ g}}$$

Check

Show me the correct answer

Show me the solution

5. Convert 5000 cc to liters.

$$\frac{5000 \text{ cc}}{1} \times \frac{1 \text{ L}}{1000 \text{ cc}} = \boxed{5 \text{ L}}$$

Check

Name: Key

Temperature Conversion Worksheet

$$K^{\circ} = C^{\circ} + 273$$

$$F^{\circ} = 9/5 C^{\circ} + 32 \quad C^{\circ} = 5/9(F^{\circ} - 32)$$

Convert the following to Fahrenheit

- 1) $10^{\circ}C$ $50^{\circ}F$
- 2) $30^{\circ}C$ $86^{\circ}F$
- 3) $40^{\circ}C$ $104^{\circ}F$
- 4) $37^{\circ}C$ $98.6^{\circ}F$
- 5) $0^{\circ}C$ $32^{\circ}F$

Convert the following to Celsius

- 6) $32^{\circ}F$ 0
- 7) $45^{\circ}F$ $7.2^{\circ}C$
- 8) $70^{\circ}F$ $21.1^{\circ}C$
- 9) $80^{\circ}F$ $26.7^{\circ}C$
- 10) $90^{\circ}F$ $32.2^{\circ}C$
- 11) $212^{\circ}F$ $100^{\circ}C$

Convert the following to Kelvin

- 12) $0^{\circ}C$ $273K$
- 13) $-50^{\circ}C$ $223K$
- 14) $90^{\circ}C$ $363K$
- 15) $-20^{\circ}C$ $253K$

Convert the following to Celsius

- 16) $100^{\circ}K$ $-173^{\circ}C$
- 17) $200^{\circ}K$ $-73^{\circ}C$
- 18) $273^{\circ}K$ $0^{\circ}C$
- 19) $350^{\circ}K$ $77^{\circ}C$

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CHAPTER 2 REVIEW

Scientific Notation

Put the following numbers into scientific notation.

2.34×10^5 231400 6.982×10^{-4} 0.00069821

Put the following numbers into decimal form.

0.06320 6.320×10^{-2} 953210 9.5321×10^5

Counting Sig Figs

How many sig figs are in each of the following numbers?

4 0.005210 3 505×10^2 2 3500

Rounding

Round each of the following numbers to 4 sig figs.

326100 326052.3 0.03221 0.032214

Addition and Subtraction with Sig Figs

25.3210 m
 $+ 0.24 \text{ m}$
 $\hline 25.5610$

652.34 km
 $- 1.0 \text{ km}$
 $\hline 651.34$

Multiplication and Division with Sig Figs

$(3.21 \text{ cm})(1.235 \text{ cm}) = 3.96 \text{ cm}^2$

$(56.2104 \text{ ft})/(14.3 \text{ s}) = 3.93 \text{ ft/s}$

Accuracy and Precision

Mark a check on the line displaying if the following targets are accurate, precise, both, or neither.



Accurate Precise



Accurate Precise

Density

A copper penny has a density of 8.96 g/cm^3 . You find the mass of the penny to be 2.87 g . What is the volume of a penny?

G: $D = 8.96 \text{ g/cm}^3$

U: $m = 2.87 \text{ g}$

E: $V = ?$

S: $V = \frac{m}{D}$

S: $= \frac{2.87 \text{ g}}{8.96 \text{ g/cm}^3}$

$= 0.320 \text{ cm}^3$

$$\left| \frac{A-E}{A} \right| \times 100$$

Percent Error

In lab, you determine the density of platinum to be 23.65 g/cm³. The actual density is 21.45 g/cm³. What is your percent error?

$$\left| \frac{21.45 - 23.65}{21.45} \right| \times 100 = 10.26\%$$

Temperature Conversions

Fill in the following chart with the converted temperatures.

$$^{\circ}\text{C} = \text{K} - 273 \qquad \text{K} = ^{\circ}\text{C} + 273$$

$$^{\circ}\text{F} = 9/5 ^{\circ}\text{C} + 32 \qquad ^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$$

	$^{\circ}\text{C}$	K	$^{\circ}\text{F}$
1	15 $^{\circ}\text{C}$	288	59
2	104	377	219 $^{\circ}\text{F}$
3	263	536 K	505
4	6.2	279.2	43.2 $^{\circ}\text{F}$

Key

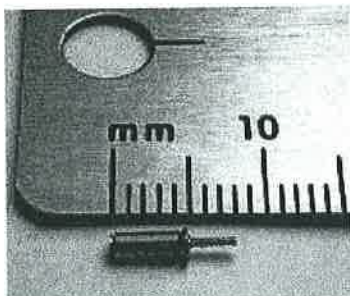
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Significant Figures Practice**Multiple-choice exercise**

Your score is 100%.

Show questions one by one



1. The length of this miniature piezo electric motor is:

- A. ? | 7.99 m
- B. ? | 8.0 cm
- C. ? | 7.98 mm
- D. ? | 8.0 mm

2. Solve: $923 \text{ g} \text{ divided by } 20 \text{ 312 cm}^3 = ?$

- A. ? | $4.00 \times 10^{-2} \text{ g/cm}^3$
- B. ? | 0.04 g/cm^3
- C. ? | 0.0454 g/cm^3
- D. ? | 0.045 g/cm^3

3. Complete the following problem: A piece of stone has a mass of 24.595 grams and a volume of 5.34 cm^3 . What is the density of the stone? (remember that density = m/v)

A. 4.606 g/cm³

B. 0.22 cm³/g

C. 4.61 g/cm³

D. 0.217 cm³/g

4. Subtract: 7.987 m - 0.54 m

A. 7.5 m

B. 7.45 m

C. 7.447 m

D. 7.4 m

$$\begin{array}{r}
 7.987 \\
 - 0.54 \\
 \hline
 7.447
 \end{array}$$

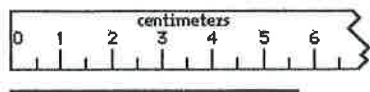
5. How many significant figures are in the measurement 0.00130 cm?

A. three

B. four

C. two

D. five



6. The length of the red line measured here is:

A. 5.65 cm

B. 5.5 cm

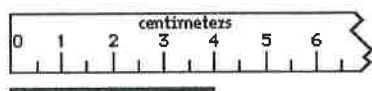
C. 5.7 cm

D. 5.712 cm



7. The arrow denotes the measured point:

- A. ? | 2.530 cm
- B. ? | 2.8 cm
- C. :-) | 2.80 cm
- D. ? | 2.53 cm



8. When measuring the length of this red line with the metric ruler provided, the first decimal place that is uncertain is:

- A. ? | thousandths of a centimeter
- B. ? | hundredths of a centimeter
- C. ? | meters
- D. ? | tenths of a centimeter

9. The mass of a watch glass was measured four times. The masses were 99.997 g, 100.008 g, 100.011 g, and 100.005 g. What is the average mass of the watch glass?

- A. ? | 100.00525 g
- B. ? | 100.0 g
- C. ? | 100.005 g
- D. ? | 100.01 g

10. How many significant figures are in the measurement 1.3000 meters?

- A. ? | four
- B. ? | three
- C. ? | five

D. two

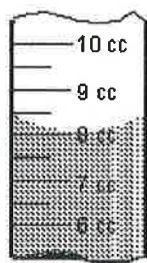
11. Solve: $123\,000\text{ m} \times 3\,234\text{ m} = ?$

A. 398 m^2

B. 39800000 m^2

C. $3.98 \times 10^8\text{ m}^2$

D. $3.97 \times 10^{-7}\text{ m}^2$



12.

The volume of liquid being measured in the graduated cylinder is:

A. 8.50 cm^3

B. 8.00 cm^3

C. 8.0 cm^3

D. 8.000 cm^3

13. Convert the following measurement to scientific notation: $101\,000\text{ grams}$

A. $1.01 \times 10^5\text{ g}$

B. $1.01000 \times 10^5\text{ g}$

C. $10.1 \times 10^4\text{ g}$

D. $1.0100 \times 10^{-5}\text{ g}$

14. Solve: $1.23\text{ m} \times 0.89\text{ m} = ?$

A. 1.1 m^2

B. 1.09 m^2

C. ? | 1.0947 m²

D. ? | 1.0 m²

15. How many significant figures are in the measurement 102.400 meters?

A. ? | five

B. ? | four

C. ? | six

D. ? | three

16. Round the following measurement to three significant figures: 0.90985 cm²

A. ? | 0.910 cm²

B. ? | 0.9099 cm²

C. ? | 0.909 cm²

D. ? | 0.91 cm²

17. When performing the calculation 34.530 g + 12.1 g + 1 222.34 g, the final answer must have:

A. ? | Three decimal places

B. ? | Three significant figures

C. ? | Only one decimal place

D. ? | Units of g³

$$\begin{array}{r}
 34.530 \\
 12.1 \\
 1222.34 \\
 \hline
 1268.970
 \end{array}$$

18. Solve: 13.004 m + 3.09 m + 112.947 m = ?

A. ? | 129.041 m

B. ? | 129.04 m

C. ? | 129 m

D. ? | 129.0 m

$$\begin{array}{r}
 13.004 \\
 3.09 \\
 + 112.947 \\
 \hline
 129.041
 \end{array}$$

19. Solve: $3.12 \text{ g} + 0.8 \text{ g} + 1.033 \text{ g} = ?$

- A. ? | 5.0 g
- B. ? | 4.9 g
- C. ? | 4.953 g
- D. ? | 5 g

$$\begin{array}{r} 3.12 \\ 0.8 \\ 1.033 \\ \hline 4.953 \end{array}$$

20. Solve: $345.009 \text{ g} - 23.009 \text{ g} = ?$

- A. ? | 322
- B. ? | 322.000 g
- C. ? | 322.00 g
- D. ? | 322 g

$$\begin{array}{r} 345.009 \\ - 23.009 \\ \hline 322.000 \end{array}$$

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