# Measurement Quiz A

1. If you had a small hunk of nickel metal, and measured the volume to be 84.00 mL, what would be its mass?

2. How many mL are in 2,455 liters?

3. Convert 275 Kelvin to centigrade.

4. Which is the coldest temperature? 10 Kelvin $10^{o}C$ $10^{o}F$

5. Which is the hottest temperature? 280 Kelvin $8.0^{o}C$ $32^{o}F$

6. A student you might know measured a piece of metal to have mass of exactly 2028.43 grams and a volume of 105.1 $cm^3$. What metal is it, and what is the symbol for it?

7. You measure a chunk of niobium to have density of 8.00 g/mL What is your percent error?

8. Do this calculation: $(3.5 \times 10^{6})(2.0 \times 10^{2}) =$

9. Do this calculation:
$$\begin{array}{r} (3.3 \times 10^{8}) \\ \underline{+ (1.2 \times 10^{7})} \end{array}$$

10. Explain what unlimited significant figures means in less than 3 sentences.

Measurement Quiz A ANSWERS

1. If you had a small hunk of nickel metal, and measured the volume to be 84.00 mL, what would be its mass?
   THINK: nickel has a density on table S. Look that up. Using the density formula, put the density value and the volume value where they belong, solve for mass. Note, 84.00 mL is the SAME as 84.00 $cm^3$. Change that if you like, but it's unnecessary.

$$\text{Density} = \frac{\text{Mass}}{\text{volume}} \longrightarrow 8.90\ g/cm^3 = \frac{\text{Mass}}{84.00\ cm^3}$$

$$\text{Mass} = (8.90\ g/cm^3)(84.00\ cm^3) = 747.6 \text{ grams (4 SF)}$$

2. How many mL are in 2,455 liters? First this: there are 1000 mL = 1 liter. A "milli" is one thousandth or $10^{-3}$ of the unit in question. There are 1000 mm in 1 meter. There are 1000 milligrams in one gram.
   Look at table "C", note "milli" is $10^{-3}$, or one thousandth of a full unit. So,

$$\frac{2455\ L}{1} \times \frac{1000\ mL}{1\ L} = 2455\ mL$$

3. Convert 275 Kelvin to centigrade. $K = C + 273 \longrightarrow 275 = C + 273 \longrightarrow 2^oC = C$

4. Which is the coldest temperature? 10 K $10^oC$ $10^oF$ 10 K is closest to absolute zero

5. Which is the hottest temperature? 280 Kelvin $8.0^oC$ $32^oF$ $8.0^oC$, because $8.0^oC = 274$ K, and $32^oF = 273$ K

6. A student you might know measured a piece of metal to have mass of exactly 2028.43 grams and a volume of 105.1 $cm^3$. What metal is it, and what is the symbol for it? Density formula again, mass/volume = density, then, go to table S and LOOK. 2028.43 g/105.1 $cm^3$ = 19.3 $g/cm^3$, that's W, which is tungsten

7. You measure a chunk of niobium to have density of 8.00 g/mL What is your percent error? Your MV is 8.00 g/mL while the AV (from table S) is 8.57 g/mL. NOTE: 1 $cm^3$ = 1 mL, they can be interchanged.
   Percent error formula, watch SF, and make sure your answer has a sign (+ or—).

$$\%\ \text{Error} = \frac{MV—AV}{AV} \times 100\% = \frac{8.00\ g/mL—8.57\ g/mL}{8.57\ g/mL} \times 100\% = —6.65\%$$

8. Do this calculation: $(3.5 \times 10^6)(2.0 \times 10^2) = 7.0 \times 10^8$
   The rule here is to multiply the coefficients (3.5 x 2.0 = 7.0), then ADD the exponents (6 + 2 = 8)

9. Do this calculation:

$$\begin{array}{rr} 3.3 \times 10^8 & 3.3 \times 10^8 \\ \underline{+\ 1.2 \times 10^7} & \underline{+\ 0.12 \times 10^8} \\ & 3.42 \times 10^8 \end{array} \qquad 3.4 \times 10^8$$

The rule here is to FIRST get the same exponent, but "tea potting" the second expression. Since we make the exponent 10X bigger (from $10^7$ to $10^8$), the coefficient becomes 10X smaller at the same time (1.2 becomes 0.12). Then, add coefficients, keep the exponents, fix SF.

10. Explain what unlimited significant figures means in less than 3 sentences. Equalities have unlimited SF.
The density of water is the equality of 1.0 grams water = 1.0 cm3 of water. Which can be 1g/1 mL, or 1.0000 g/ 1.0000 mL, or even 1.00000000000000000 g/ 1.00000000000000000 mL. These values are equal to the "$n^{th}$" number of SF, there is NO LIMIT to how many SF you can have it you want them. All equalities, all constants, have unlimited SF. They do not limit your answer's SF ever.

# Measurement Quiz B

1. Define qualitative measurement, give a few examples.

2. Define quantitative measurements, give a few examples.

The density of pure water is 1.0 g/mL. Eight sets of students in lab made measurements in this data set. Use the data to answer the next few questions.

| Set | Measured density |
|---|---|
| Set 1 | 0.84 g/mL |
| Set 2 | 0.86 g/mL |
| Set 3 | 0.83 g/mL |
| Set 4 | 0.91 g/mL |
| Set 5 | 0.92 g/mL |
| Set 6 | 0.90 g/mL |
| Set 7 | 0.99 g/mL |
| Set 8 | 1.0 g/mL |

3. Which students were accurate?
   A. set 1-3 B. set 4-6 C. set 7-8 D. none of them

4. Which students were precise?
   A. Sets 8, 5, and 1 B. Sets 7, 4, and 3
   C. Sets 3, 2, and 1 D. Sets 3, 4, and 7

5. Which sets of students were accurate and precise?
   A. Sets 1 and 2 B. 4 and 5
   C. Sets 5 and 6 D. Sets 7 and 8

6. Write this number in scientific notation: 35,730,000 grams

7. Write this number in scientific notation 0.00000348003 meters

8. Do this addition: $2.35 \times 10^{7}$
   $+1.34 \times 10^{6}$

9. Using dimensional analysis (unit conversion math) convert 17.0 years into hours.

10. Using dimensional analysis (unit conversion math) convert 2.469 tons into grams.
    You should know this: 1 ton = 2000 pounds 1 pound =454 grams

Measurement Quiz B

1. Define qualitative measurement, give a few examples. Qualitative measures do not use numbers or units, they use "qualities". Examples include hot or cold, bigger or smaller, bubbly or still.

2. Define quantitative measurements, give a few examples. Quantitative measures use numbers AND units. Examples include 23.56 grams, 284 Kelvin, or saying your salty water is exactly a 1.55 molar solution.

The density of pure water is 1.0 g/mL. Eight sets of students in lab made measurements in this data set.
Use the data to answer the next few questions.

| Set | Measured density |
|---|---|
| Set 1 | 0.84 g/mL |
| Set 2 | 0.86 g/mL |
| Set 3 | 0.83 g/mL |
| Set 4 | 0.91 g/mL |
| Set 5 | 0.92 g/mL |
| Set 6 | 0.90 g/mL |
| Set 7 | 0.99 g/mL |
| Set 8 | 1.0 g/mL |

3. Which students were accurate? C. set 7-8 Accurate means that your measurements are very close to the actual, you have a very small percent error.

4. Which students were precise? C. Sets 3, 2, and 1 Precise means that the measured values are close together, so "C" is the only choice here that is correct. The data does let you say that Sets 4, 5 and 6 are also precisely measured, but that wasn't a choice in this question. Sets 7 + 8 are accurate, but they are precise as well. You can be both precise and accurate in chemistry (that's the best).

5. Which sets of students were accurate and precise? D. Sets 7 and 8

6. Write this number in scientific notation: 35,730,000 grams $3.573 \times 10^{7}$ grams

7. Write this number in scientific notation 0.00000348003 meters $3.48003 \times 10^{-6}$ meters

8. Do this addition:

$$\begin{array}{r} 2.35 \times 10^{7} \\ \underline{+1.34 \times 10^{6}} \end{array} \qquad \begin{array}{r} 2.35 \times 10^{7} \\ \underline{+0.134 \times 10^{7}} \\ 2.484 \times 10^{7} \end{array} \longrightarrow 2.48 \times 10^{7}$$

The rule here is to make the exponents the same but adjusting the coefficients, then adding, and fixing the SF.

9. Using dimensional analysis (unit conversion math) convert 17.0 years into hours.

$$\frac{17.0 \text{ years}}{1} \times \frac{365 \text{ days}}{1 \text{ year}} \times \frac{24 \text{ Hours}}{1 \text{ day}} = 148{,}920 \text{ Hours} \qquad 149{,}000 \text{ Hours with 3 SF}$$

10. Using dimensional analysis (unit conversion math) convert 2.469 tons into grams, write answer in scientific notation.
You should know this: 1 ton = 2000 pounds 1 pound =454 grams

$$\frac{2{,}469 \text{ tons}}{1} \times \frac{2000 \text{ pounds}}{1 \text{ ton}} \times \frac{454 \text{ grams}}{1 \text{ pound}} = 2{,}241{,}852{,}000 \text{ grams} = 2{,}242{,}000{,}000 \text{ g} = 2.242 \times 10^{9} \text{ g}$$

# Measurement Quiz C

1. You find a hunk of bismuth metal and it's mass is exactly 100.70 grams. What is it's volume?

2. You measure a hunk of iron to have volume of exactly 100.0 $cm^3$. What is it's mass?

3. You measure a hunk of tin to have density of 7.515 $g/cm^3$. What is your percent error?

4. You melt lead in your garage to make fishing lures with Uncle Mick, what temperature in centigrade does that occur?

5. Your weird Uncle Nick is worried about werewolves, and so he talks you into melting silver to make some special silver bullets (the only way to dispatch a werewolf). What temperature does silver melt in °C? (round to 3 SF)

6. Look at table S, make a list showing the atomic radius of a chlorine atom, an argon atom, and of potassium atom. How many significant figures are in each of these measurements?

7. In a thermochemistry problem that has these measurements: 55,690 Joules, 235.75 grams, C = 4.18 J/g·K, and an unknown $\Delta T$, how many significant figures would be in this change of temperature?

8. Six teams in lab measured the volume of the same piece of metal, and their measurements were:
   45.76 $cm^3$, 46.03 $cm^3$, 56.98 $cm^3$, 57.04 $cm^3$, 56.89 $cm^3$, and 56.91 $cm^3$.
   The actual volume of this metal is 45.87 $cm^3$. Which statement OR STATEMENTS best describe these results?
   A. All measurements are accurate
   B. The first two are accurate, and the rest are accurate as well
   C. The last four are accurate, the first two are not
   D. The first two are accurate, the rest are not accurate.
   E. The last four measures are not accurate but they are precise
   F. The first two measures are accurate and precise
   G. The last four measures are accurate but they are not precise

9. Your teacher said that the best element of all is mercury. He loves the idea of liquid metals, and as a child he played with it many times. Now we know mercury is both carcinogenic and also can cause brain damage so it is never allowed in public schools. That explains a lot of things. Is the statement Mercury is the best element a qualitative or quantitative measurement?

   Give an example of both a qualitative and a quantitative measurement.

10. Convert 500. yards (20 laps in the Vestal pool) into millimeters, put your answer in to scientific notation.
    (1 inch = 2.54 cm)

# Measurement Quiz C

1. You find a hunk of bismuth metal and it's mass is exactly 100.70 grams. What is it's volume? Density formula math

$$\frac{9.79\ g/cm^3}{1} = \frac{100.70\ g}{volume} \quad = (9.79\ g/cm^3)(V) = 100.70\ g \qquad V = 10.286\ cm^3 \quad \text{(5 SF, density has unlimited SF)}$$

2. You measure a hunk of iron to have volume of exactly 100.0 $cm^3$. What is it's mass? Density formula math

$$\frac{7.87\ g/cm^3}{1} = \frac{MASS}{100.0\ cm^3} \quad = MASS = (7.87\ g/cm^3)(100.0\ cm^3) \quad MASS = 787.0\ grams \text{ (4 SF, density has unlimited SF)}$$

3. You measure a hunk of tin to have density of 7.515 $g/cm^3$. What is your percent error?

$$\%\ E = \frac{MV—AV}{AV} \times 100\% = (0.228 / 7.287) \times 100\% = -3.1289\% \quad \text{(5 SF in your measurement, unlimited on table S)}$$

4. You melt lead in your garage to make fishing lures with Uncle Mick, what temperature in centigrade does that occur?
   K = C + 273  600. K = C + 273  C = 327 °C

5. Your weird Uncle Nick is worried about werewolves, and so he talks you into melting silver to make some special silver bullets (the only way to dispatch a werewolf). What temperature does silver melt in °C? (round to 3 SF)
   K = C + 273  1235 K = C + 273  C = 962 °C

6. Look at table S, make a list showing the atomic radius of a chlorine atom, an argon atom, and of potassium atom. How many significant figures are in each of these measurements? Cl 100. pm  Ar 101 pm  K 200. pm  ALL have 3 SF

7. In a thermochemistry problem that has these measurements: 55,690 Joules, 235.75 grams, C = 4.18 J/g·K, and an unknown ΔT, how many significant figures would be in this change of temperature? 4 SF in joules, 5 SF in mass, unlimited SF in specific heat, so the answer is limited to the LEAST SF, answer requires 4 SF.

8. Six teams in lab measured the volume of the same piece of metal, and their measurements were:
   45.76 $cm^3$, 46.03 $cm^3$, 56.98 $cm^3$, 57.04 $cm^3$, 56.89 $cm^3$, and 56.91 $cm^3$.
   The actual volume of this metal is 45.87 $cm^3$. Which statement OR STATEMENTS best describe these results?
   A. All measurements are accurate NO, the first two are, the last four are terrible.
   B. The first two are accurate, and the rest are accurate as well NO, the first two are accurate, the last four stink.
   C. The last four are accurate, the first two are not. NO this is backwards.
   D. The first two are accurate, the rest are not accurate. CORRECT.
   E. The last 4 measures are not accurate but they are precise. CORRECT. The measures stink, but they ARE CONSISTENT = precise.
   F. The first two measures are accurate and precise. CORRECT.
   G. The last four measures are accurate but they are not precise. NO, this is reversed vocabulary words.

9. Your teacher said that the best element of all is mercury. He loves the idea of liquid metals, and as a child he played with it many times. Now we know mercury is both carcinogenic and also can cause brain damage so it is never allowed in public schools. That explains a lot of things. Is the statement Mercury is the best element a qualitative or quantitative measurement? Give an example of both a qualitative and a quantitative measurement. ALTHOUGH HE IS CORRECT, HIS MEASURE OF MERCURY IS QUALITATIVE.
   A QUANTITATVIE MEASURE HAS NUMBERS AND UNITS. The density of mercury is 13.5336 $g/cm^3$ is quantitative. The density of mercury is really high is qualitative.

10. Convert 500. yards (20 laps in the Vestal pool) into millimeters, put your answer in to scientific notation. (1 inch = 2.54 cm)

$$\frac{500.\ yd}{1} \times \frac{36\ inches}{1\ yd} \times \frac{2.54\ cm}{1\ inch} \times \frac{10\ mm}{1\ cm} = 457{,}200\ mm = 4.57 \times 10^5\ mm$$