

## Chemistry Fundamentals Review

# You will have a quiz on the common elements and ions TOMORROW.

The Periodic Table provided for AP Chemistry contains just the atomic mass, atomic number, and element symbol (not the name). Therefore, it is essential you are familiar with the name and symbol of the common elements (chances are you know most of these by heart already). It is also important for you to be familiar with the common ions (monoatomic and polyatomic). A more detailed breakdown of what you should know is included below.

### Elements to Memorize (name and symbol)

- You should know all the elements in groups 1, 2, 17, and 18.
- You should know the first 3 elements in groups 13, 14, 15, and 16
- Transition metals to know: **Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ag, Sn, Pt, Au, Hg, Pb**

**PERIODIC TABLE OF THE ELEMENTS**

1 <b>H</b> 1.008	2											13 <b>B</b> 10.81	14 <b>C</b> 12.01	15 <b>N</b> 14.01	16 <b>O</b> 16.00	17 <b>F</b> 19.00	18 <b>Ne</b> 20.18
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01											13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.06	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.30	3	4	5	6 <b>Cr</b> 52.00	7 <b>Mn</b> 54.94	8 <b>Fe</b> 55.85	9 <b>Co</b> 58.93	10 <b>Ni</b> 58.69	11 <b>Cu</b> 63.55	12 <b>Zn</b> 65.38	13 <b>Ga</b> 69.72	14 <b>Ge</b> 72.63	15 <b>As</b> 74.92	16 <b>Se</b> 78.97	17 <b>Br</b> 79.90	18 <b>Kr</b> 83.80
19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.87	23 <b>V</b> 50.94	24	25	26	27	28	29	30	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.63	33 <b>As</b> 74.92	34 <b>Se</b> 78.97	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.80
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.95	43 <b>Tc</b> (97)	44 <b>Ru</b> 101.1	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.76	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.29
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	*57 <b>La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.84	75 <b>Re</b> 186.21	76 <b>Os</b> 190.2	77 <b>Ir</b> 192.2	78 <b>Pt</b> 195.08	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.2	83 <b>Bi</b> 208.98	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (223)	88 <b>Ra</b> (226)	†89 <b>Ac</b> (227)	104 <b>Rf</b> (267)	105 <b>Db</b> (270)	106 <b>Sg</b> (271)	107 <b>Bh</b> (270)	108 <b>Hs</b> (277)	109 <b>Mt</b> (276)	110 <b>Ds</b> (281)	111 <b>Rg</b> (282)	112 <b>Cn</b> (285)	113 <b>Uut</b> (285)	114 <b>Fl</b> (289)	115 <b>Uup</b> (288)	116 <b>Lv</b> (293)	117 <b>Uus</b> (294)	118 <b>Uuo</b> (294)

### Ions to Memorize

- You should know the charges for groups 1, 2, and 13-17 ions (hint, it's related to their location on the periodic table)
- You should know the following common polyatomic ions (**name, formula and charge!**)

**Ammonium**             $\text{NH}_4^{1+}$

**Acetate**              $\text{C}_2\text{H}_3\text{O}_2^{1-}$

(also written as  $\text{CH}_3\text{COO}^{1-}$ )

**Carbonate**          $\text{CO}_3^{2-}$

**Chlorate**            $\text{ClO}_3^{1-}$

**Hydroxide**          $\text{OH}^{1-}$

**Nitrate**              $\text{NO}_3^{1-}$

**Phosphate**          $\text{PO}_4^{3-}$

**Sulfate**              $\text{SO}_4^{2-}$

## Chemistry Fundamentals Review

### Units and Significant Figures

AP Tips:

- Units are key to problem solving. If a free response question specifically asks for units to be included in your final answer, a point will be deducted if you have the correct numerical value but no units (or the incorrect unit).
- Significant Figures are important in calculations. If a free response question specifically asks for the final answer to be reported to the correct number of significant figures, a point will be deducted if your “correct” answer is not expressed to the proper number of significant figures

### Units

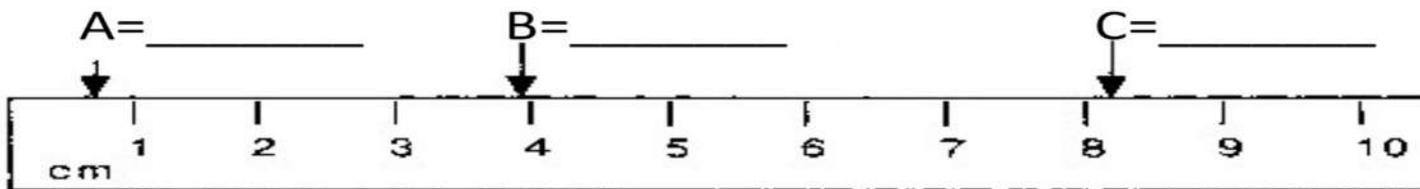
You should know the symbols for the following base units and what they measure. Note that most of these units can also be modified by powers of 10 and can be seen with prefixes.

Unit	Symbol(s)	Measurement
meter		
gram		
grams/milliliter grams/centimeter <sup>3</sup>		
moles		
Molarity		
Kelvin		
second		
Joule		
Hertz (or sec <sup>-1</sup> or 1/sec)		
kilopascals, atmospheres, millimeters of Mercury		

**Making Measurements & Estimating the Last Digit:** When using tools with graduated “tick marks”, you should estimate one decimal place beyond the value of the smallest tick mark!

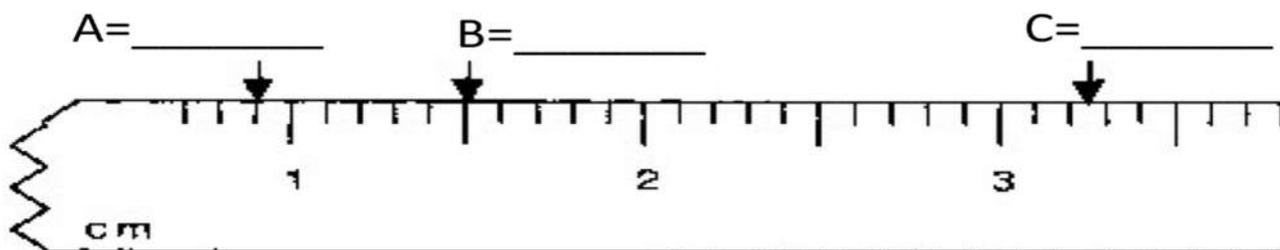
**Practice: Reading a Ruler**

1. Estimate the number of centimeters indicated by each of the arrows below.



\*\*\*Each “tick mark” is worth \_\_\_\_\_, therefore estimate to the nearest \_\_\_\_\_

2. Estimate the number of centimeters indicated by each of the arrows below.

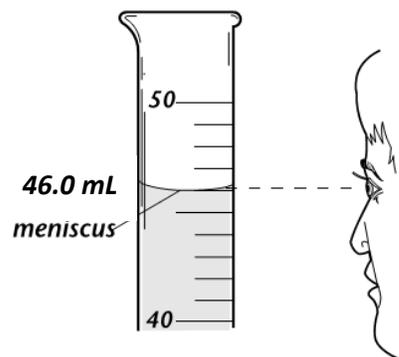


\*\*\*Each “tick mark” is worth \_\_\_\_\_, therefore estimate to the nearest \_\_\_\_\_

**Reading Graduated Cylinders:**

\*Liquids form a curved surface when in graduated cylinders.

As a standard, you should read the liquid level from the \_\_\_\_\_



**Significant Figures:**

- When we make measurements, we are limited by the measuring tool. We can only state values in a measurement that we are sure are correct.
- With each measurement, there is a degree of uncertainty/estimation beyond the markings
- The **last digit** in a measurement is called the **uncertain digit**
- Significant figures include all measured digits and the uncertain digit
- The **more** significant figures, the **more precise** the measurement

## Rules for Counting Significant Figures

1. Non-zero digits ALWAYS count as significant figures

Ex: **2371**

2. Zeroes **between** non-zero digits (“sandwiched zeroes”) are ALWAYS significant

Ex: **105**

3. Zeroes to the left of the first non-zero digit are not significant

Ex: **0.0035**

4. Zeroes to the right of the last non-zero digit are only significant **if there is a decimal point present.**

Ex 1: **1.080**

Ex 2: **100,000**

\*Think back to the “**Pacific-Atlantic Rule**” for counting sig figs.

• Decimal point **Present**, start counting on the **left (Pacific)** side with the first non-zero digit

Ex: **0.00310**

• Decimal point **Absent**, start counting on the **right (Atlantic)** side with the first non-zero digit

Ex: **31,400**

**Practice:** Underline and identify the number of significant figures in the following measurements. Also, identify the type of measurement indicated by the unit.

Measurement & Unit	# of Significant Figures	Type of Measurement
467 nm		
520 mL		
0.0102 ms		
0.230 kg		
25,600 L		
10.002 ms		
0.451 Pa		
0.001 cm		
298.15 K		
$6.022 \times 10^{23}$ molecules		
5000. mL		

### Rules for Significant Figures in Calculations

1. When **adding and subtracting**, round the final answer to the same number of **decimal places** as the measurement with the fewest decimal places.

Ex: 
$$\begin{array}{r} 89.332 \\ +1.1 \\ \hline 90.432 \end{array}$$

2. When **multiplying and dividing**, round the final answer to the same number of **significant figures** as the measurement with the fewest significant figures.

Ex: 
$$4.51 \times 3.6666 = 16.536366 = 16.5$$

3. When performing calculations with multiple steps, carry as many numbers as possible throughout the calculations and **only round off the final answer**. Round the final answer off based on the last calculation performed.

**Practice:** Perform the following calculations.

Original Problem	Raw Answer	Final Answer w/ Proper Sig Figs and Units
$0.3287 \text{ g} \times 45.2 \text{ g}$		
$125.5 \text{ kg} + 52.68 \text{ kg} + 2.1 \text{ kg}$		
$0.258 \text{ mL} + 0.36105 \text{ mL}$		
$1250 \text{ cal} - (234.207 \text{ cal} \div 52.69 \text{ cal})$		
$\frac{52.8 \text{ Pa} + 3.0025 \text{ Pa}}{253.4 \text{ Pa}}$		

## Practice Worksheet for Significant Figures

1. State the number of significant digits in each measurement.

1) **2804 m**

2) **2.84 km**

3) **5.029 m**

4) **0.003068 m**

5)  **$4.6 \times 10^5$  m**

6)  **$4.06 \times 10^{-5}$  m**

7) **750 m**

8) **75 m**

9) **75,000 m**

10) **75.00 m**

11) **75,000.0 m**

12) **10 cm**

2. Round the following numbers to four significant figures:

**3.682417**

**21.860051**

**375.6523**

**112.511**

**45.4673**

3. Solve the following problems and report answers with appropriate number of significant digits and units.

1)  **$6.201 \text{ cm} + 7.4 \text{ cm} + 0.68 \text{ cm} + 12.0 \text{ cm} =$**

2)  **$1.6 \text{ km} + 1.62 \text{ m} + 1200 \text{ cm} =$**

3)  **$8.264 \text{ g} - 7.8 \text{ g} =$**

4)  **$10.4168 \text{ m} - 6.0 \text{ m} =$**

5)  **$12.00 \text{ m} + 15.001 \text{ m} =$**

6)  **$1.31 \text{ cm} \times 2.3 \text{ cm} =$**

7)  **$5.7621 \text{ m} \times 6.201 \text{ m} =$**

8)  **$20.2 \text{ cm} / 7.41 \text{ s} =$**

9)  **$40.002 \text{ g} / 13.000005 \text{ g} =$**