General Chemistry

Lecture Worksheet 2 – Units and Implications of Measurement

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Course	Unit 1	Chapter 1
General Chemistry	Molecular Structure and Properties	Introduction

This worksheet is part of the MEEP curriculum on General Chemistry. The corresponding lecture and other general chemistry lectures are available below.

- Corresponding Lecture: https://yfmeep.com/lecture-2-units-and-implications-of-measurement/
- General Chemistry: https://yfmeep.com/learn/chem/genchem/

Information regarding Project MEEP can be accessed here: https://yfmeep.com/home/

Lecture Preview Questions

Answer the following questions using a few sentences.

1. How do we describe the amount of something and how is it standardized?

2. How are accuracy and uncertainty implied in measurements?

3. How can we convert between different units of measurements?

4. What is the concept of a mole?

Lecture Content

We will encounter these in future chapters. Might as well start practicing early to make our lives easier when we eventually (and inevitably) get there.

There are _____ SI base units. Other units _____ (can/cannot) be derived from those base units.

Fill in the blanks using SI base units.

Unit Symbol	Measurement Description
	It describes how much time has passed.
	It describes the mass of a matter.
	It describes the amount of substance.
	It describes thermodynamic temperature.
	It describes the length of an object.
m^3	
$\frac{kg}{m^3}$	
$\frac{kg}{m \cdot s^2}$	

Fill in the blanks regarding unit prefixes.

Name	Prefix	Factor	Name	Prefix	Factor
Pico			Milli		
Nano			Centi		
Micro			Kilo		

In other words, 1 picometer is equal to _____ meter, while 1 gram is equal to _____ micrograms.

We start counting significant figures starting from the _____ digit. For this course, we will assume that numbers like 142000 have _____ sig figs.

Write an example for each of the following rounding rules. (Round to 4 sig figs)

If the digit dropped is larger than 5, we increase the retained digit by 1.	
If the digit dropped is smaller than 5, we keep the retained digit as the same.	
If the digit dropped is equal to 5 and/or has trailing 0's after, we increase by 1 or maintain the retained digit such that the retained digit is even.	
If the digit dropped is equal to 5 but has trailing non-0 digits, we increase the retained digit by 1.	

For adding and subtracting measurements, we determine the number of significant figures of the result by observing the _____ of the numbers in calculation. For multiplying and dividing measurements, we determine the number if significant figures of the result by observing the _____ of the numbers in calculation.

Do constants or scaling factors follow sig fig rules? _____.

N_A is called _____. For this course, it is equal to _____. (Include units).

What is the formula used for calculating the mole of a substance, given the number of particles of said substance?

How do we convert between Celsius and kelvin? (An equation/formula can suffice).

Review

Remember to calculate with significant figure rules in mind and include units. Numbers written in scientific notation need to follow respective rules.

Fill in the blanks with the appropriate SI base units. Use prefixes when appropriate.

A blink of the eyes takes approximately 300 _____.

An egg has a mass of approximately 50 _____.

10^{-9} of a meter is a _____.

An average human weighs around 60-80 _____.

The width of a fingernail is around 10 _____.

A skyscraper usually has a height of at least 0.350 _____.

Convert the following units.

$100km = \_\_\_\_\_ mm$ $5.20mmol = \_\_\_\_\_ mol$ $36\mu s = \_\_\_\_\_ ms$

$7.01L = \_\_\_\_\_ mL$ $69 \times 10^7 mm^3 = \_\_\_\_\_ m^3$

$1.689 \times 10^3 \frac{kg}{m^3} = \_\_\_\_\_ \frac{g}{cm^3}$ $22.4 \frac{mmol}{L} = \_\_\_\_\_ \frac{mol}{L}$

Round the following numbers to 3 significant figures.

$2.9156 \times 10^4 kg = \_\_\_\_\_ kg$ $0.0064110mol = \_\_\_\_\_ mol$

$19.9712 \frac{g}{cm^3} = \_\_\_\_\_ \frac{g}{cm^3}$ $359.500 \frac{mmol}{L} = \_\_\_\_\_ \frac{mmol}{L}$

Perform the following calculations, given that all values are measurements. Remember, if they have different prefixes, we need to convert them to the same prefix before calculating. Use a calculator.

Example: $15.751g + 0.00250kg = 15.751g + 2.50g = 18.251g = 18.25g$

1. $12.4g + 7.89g =$
2. $45.6s + 0.1234ms =$
3. $3.45mol + 8.9012mol =$
4. $100.55kg + 25.7kg =$
5. $0.0091 \frac{mol}{L} + 2.34 \frac{mmol}{L} =$
6. $20.51mL - 7.3mL =$
7. $50.0012g - 25.55g =$
8. $8.9K - 3.4567K =$
9. $200.0g - 0.12345kg =$
10. $5.0051mmol - 1.23mmol =$

Perform the following calculations, given that all values are measurements. Remember to use the correct units for the results. However, if the same units have different prefixes, convert them to the same prefix. Use a calculator.

Example: $15.1m \times 1400cm = 15.1m \times 14m = 211.4m^2 = 210m^2$

1. $12.4\frac{m}{s} \times 3.56s =$
2. $45.6cm \times 0.123m =$
3. $3.45\frac{kg}{m^3} \times 8.9m^3 =$
4. $100.0cm \times 2.34cm =$
5. $0.0091\frac{mmol}{L} \times 12.3L =$
6. $20.5m \div 3.2s =$
7. $50.001cm^3 \div 25.5mm =$
8. $8.90g \div 0.456L =$
9. $100.0mmol \div 1.234L =$
10. $5.005\frac{kg \cdot m}{s^2} \div 0.123m^2 =$

Perform the following unit conversions given the conversion factors. We haven't talked about some units here yet, but questions are doable. (Recall which value should follow sig fig rules, and yes, those units will come up in the future, that's why we're practicing them early)

$1\ atm = 101300\ Pa$

$1\ mmHg = 133.3\ Pa$

$1\ L = 1.0567\ qt$

$1\ kg = 2.2046\ lb$

1. $1.44\ atm =$ _____ Pa
2. $942.0\ Pa =$ _____ $mmHg$
3. $2.3\ atm =$ _____ $mmHg$

Suppose you know that the density of a substance is in an obscure unit: $5.64\ lb/qt$. Convert the value into g/cm^3.

Suppose you measured $2.51\ mol$ of oxygen molecules. How many oxygen molecules (in number of particles) are there? We will encounter more problems related to the mole in future chapters.