Welcome to our CHEM 4 lecture

- Go to LearningCatalytics.com **Session ID =**
- While we wait, please start on the review question below.

Clicker question: Review from last class

1) Determine the answer to the following calculation using the correct number of significant figures.

$$\frac{(13.001)(640)}{(2.10\ x\ 10^{-4})} = 39{,}622{,}095.24 = 4.0 \times 10^{7}$$

5sf *2sf* *3sf*

A) 0.40
B) 0.396
C) 0.4
D) 0.39
E) 0.396220952
F) 4×10^{7}
G) 40,000,000
H) 4.0×10^{7}
I) 3.9×10^{7}
J) 3.96×10^{7}

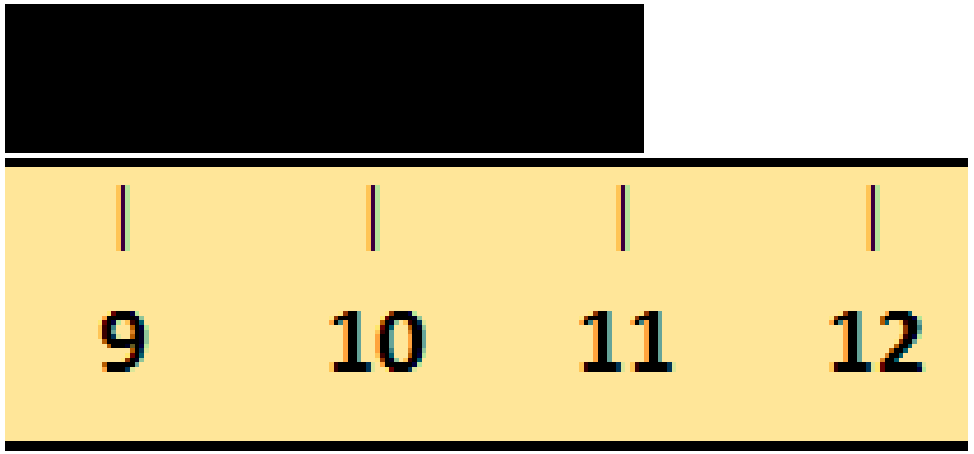
- *Need to keep only 2 sf in the answer.*
- *Leftmost dropped digit is "6" so round up to 40,000,000.*
- *Then report your answer with 2 sf using scientific notation.*
- *If you answered A)-E), you forgot to put the denominator in parentheses in your calculator.*

Clicker question: Review from last class

Go to LearningCatalytics.com Session ID =

2) The length of the black stripe is between 11 cm and 12 cm as seen in the photo below. Which measurement is reasonable to record in your lab note book?

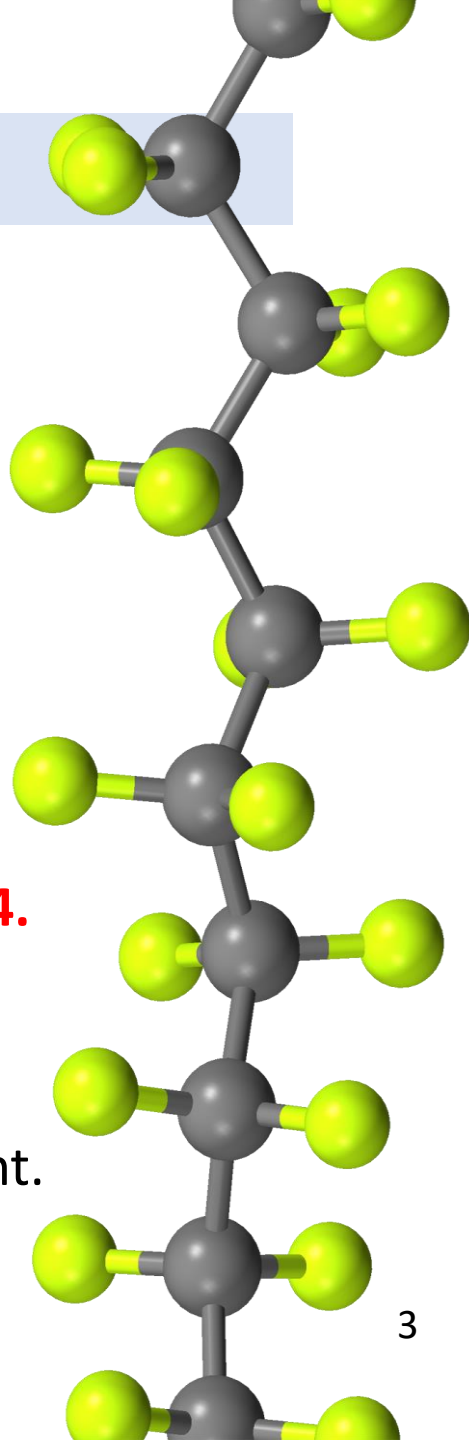
A) about 10 cm
B) 11 cm
C) 12 cm
D) 11.1 cm
E) 11.7 cm
F) 11.05 cm
G) 11.10 cm
H) 11.15 cm



- We are *sure* about the 11 cm because the smallest marking on the ruler is the 1's place.
- Then we get a *guess digit*. It should be 1/10th of the smallest marking.
- Our *guess digit* should be in the 10^{ths} place.
- Although 11.7 cm also has its *guess digit* in the 10^{ths} place, it is not a reasonable guess.

Key to Success in CHEM 4

- ✓ Visit our CHEM 4 website regularly: tinyurl.com/SacStateChem4
- ✓ Attend every lecture having completed the assigned reading.
- ✓ Review our PowerPoint slides and/or lecture recordings after each class.
- ✓ Keep up with daily homework. **However, all students will automatically receive full credit for all late homework this semester.**
- ✓ Complete all of the practice exams.
- ✓ Start formal studying for exams 1 week early.
- ✓ **Talk to your Commit to Study peer mentor about how you are doing in CHEM 4.**
- ✓ Get help when needed:
  - ✓ Put together a weekly study group.
  - ✓ Jeff's office hours: MWF 9 – 9:30 am and 11 – 11:30 am; and by appointment.
  - ✓ PAL office hours: link is on our CHEM 4 website.



Class voted on Monday

What do you want to do for week #9?

A) Heat capacity (3.12 cont.) and review session **113 votes**

B) Heat capacity (3.12 cont.) and climate change **28 votes**

C) Climate change and review session **94 votes**

So we'll keep the calendar the way it is for October.

#9 **Oct 26**	Rd: 3.12 cont. Heat capacity	**Review Session:** **Exam #2**	**Exam #2**

- When I have some free time (hopefully this weekend), I will record my climate change lecture and post it for students who are interested in learning about this important issue that impacts all of us.
- Watching the climate change lecture will be optional and you will not be tested on any material covered in the lecture.

Chemistry in the News

The American biochemist Jennifer A. Doudna (UC Berkeley) and French microbiologist Emmanuelle Charpentier (Max Planck Institute) won the 2020 Nobel Prize in chemistry for their work on "genetic scissors" **CRISPR** (clustered regularly interspaced short palindromic repeats) that can cut DNA at a precise location, allowing scientists to make specific changes to specific genes.

They are the first women to jointly win the Nobel Prize in Chemistry, and the sixth and seventh women to win the chemistry prize.

Francis Collins, director of the National Institutes of Health, says, "You cannot walk into a molecular biology laboratory today, working on virtually any organism, where CRISPR-Cas9 is not playing a role in the ability to understand how life works and how disease happens. It's just that powerful."

Jennifer Doudna (left) and Emmanuelle Charpentier pictured together in 2016.

CHEM 4 lecture

Wednesday – October 7, 2020

Sec 2.4 cont., 5.11

Formula mass

Reading clicker question (Covers material from today's assigned reading)

Go to LearningCatalytics.com Session ID =

3) Which of the following statements is true?

A) When adding and subtracting, the answer has the same number of significant figures as the measurement with the fewest sig. figs.

B) H_2O has a greater formula mass than H_2O_2.

C) A compound's formula mass depends on how much of the compound you have.

D) Formula mass is found by adding the atomic masses of all the atoms in a chemical formula.

E) Formula mass can only be calculated for substances with 2 elements.

Background: Determining answers for calculations (+/-)

For +/-, answers should have the same # of **decimal places** as the measurement with the fewest decimal places.

Example A:

$$\begin{array}{r} 4.8 \\ -\ 3.965 \\ \hline 0.835 = 0.8 \end{array}$$

Notice: this is not the answer we'd get if we were looking at sig figs instead of decimal places.

Example B: Add 1.009 m + 1.2 x 10^3 m. Report your answer with the correct number of digits.

- Undo the scientific notation so you can see what place the "2" actually is in.

$$\begin{array}{r} 1.009 \\ +\ 1200 \\ \hline 1201.009 \end{array}$$

smallest digit is in the thousandths place

smallest digit is in the hundreds place

need to keep only hundreds place

= 1200 — use scientific notation to avoid ambiguous zeros

= 1.2 x 10^3 m

Notice: 1.009 is so small compared to the smallest "good" digit in 1200 that it doesn't impact the answer.

Progress clicker question (covers material we are learning now)

Go to LearningCatalytics.com Session ID =

4) Which of the following four problems is not shown with its correct answer?

A) 0.003 + 0.008 = 0.011

$$\begin{array}{r} 0.003 \\ +\ 0.008 \\ \hline 0.011 \end{array}$$ ✓

B) 1306 - 4 = 1302

$$\begin{array}{r} 1306 \\ -\ \ 4 \\ \hline 1302 \end{array}$$ ✓

C) 3.87 – 1.07 = 2.8

$$\begin{array}{r} 3.87 \\ 1.07 \\ \hline 2.80 \end{array}$$ X

needs the zero in the hundredths place even if your calculator leaves it off.

D) 53 + 9 + 78 = 1.40×10^2

$$\begin{array}{r} 53 \\ 9 \\ 78 \\ \hline 140 \end{array}$$ ✓

want the ones place, but 140 has an ambiguous zero, so use scientific notation.

Background: Calculating formula mass

This rule about adding measurements has application when we determine a compound's **formula mass**.

$$\text{formula mass} = \left(\begin{array}{|c|}\hline \text{\# atoms of 1st element in chemical formula} \\ \hline\end{array} \times \begin{array}{|c|}\hline \text{atomic mass of 1st element} \\ \hline\end{array}\right) + \left(\begin{array}{|c|}\hline \text{\# atoms of 2nd element in chemical formula} \\ \hline\end{array} \times \begin{array}{|c|}\hline \text{atomic mass of 2nd element} \\ \hline\end{array}\right) + \ldots$$

Steps:

1) Write the chemical formula
2) Look up the individual atomic masses from periodic table
3) Use the above equation to find the formula mass
4) Report the answer with the correct number of decimal places and units (amu)

Textbook error

Example 5.15 Calculating Formula Mass

Calculate the formula mass of carbon tetrachloride, CCl_4.

SOLUTION

To find the formula mass, sum the atomic masses of each atom in the chemical formula.

$$\begin{aligned}\text{formula mass} &= 1 \times (\text{atomic mass C}) + 4 \times (\text{atomic mass Cl}) \\ &= 12.01 \text{ amu} + 4\,(35.45 \text{ amu}) \\ &= 12.01 \text{ amu} + 141.80 \text{ amu} \\ &= 153.8 \text{ amu}\end{aligned}$$

$$\begin{array}{r} 12.01 \\ 35.45 \\ 35.45 \\ 35.45 \\ +\ 35.45 \\ \hline 153.81 \end{array}$$

- The “1” and “4” are exact numbers and are short-hand for adding
- All of the masses have a 100^{ths} place and therefore so should our answer

Progress clicker question (covers material we are learning now)

Go to LearningCatalytics.com Session ID =

5) Calculate the formula mass of lithium perbromate.

A) 150.841 amu

B) 150.84 amu

C) 150.8 amu

D) 151 amu

E) 150 amu

F) 1.5×10^2 amu

Answer:

$LiBrO_4$

Smallest digit is in the thousandths place

Smallest digits are in the hundredths place

formula mass = (1)(6.941) + (1)(79.90) + (4)(16.00)

= (6.941) + (79.90) + (64.00)

= 150.841

so, keep 100^{ths} place

= 150.84 amu

Notice that this does not match the answer we'd get if we were looking at sig figs instead of decimal places.

Progress clicker question (covers material we are learning now)

Go to LearningCatalytics.com Session ID =

6) Calculate the formula mass of antimony(III) hydroxide.

A) 172.824 amu

B) 172.82 amu

C) 172.8 amu

D) 173 amu

E) 170 amu

F) 1.7×10^2 amu

Answer:

$Sb(OH)_3$

10^{ths} place *100^{ths} place* *1000^{ths} place*

formula mass = (1)(121.8 amu) + (3)(16.00 amu) + (3)(1.008 amu)

= (121.8 amu) + (48.00 amu) + (3.024 amu)

= 172.824 amu *(keep the 10^{ths} place)*

= 172.8 amu