Chem 106: Class/ Lab

Week 3

Sign in: Roster @ front of lab

If there is ** next to your name you have not answered the course survey and have not provided an e-mail address:

Complete & submit the form with the information as soon as possible

If there is an * you are missing 1 or more on-line assignments other than the learning survey

If necessary, see Dr. R. before leaving lab today to check on missing assignments

Be sure to click on any link saying "Guiding Questions" (GC) in the course calendar and ***submit*** answers

"Guiding Questions" example from course calendar

Provide all information and answers

Be sure to hit ***submit*** at the bottom of each form

Chem 106: Class/ Lab

Week 3

Class Survey Results

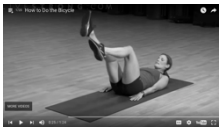
	2016 Rank	2017 Rank
C. Climate Change	1	1
T. Social Injustice	1	5
M. Jobs	1	1
F. Depletion of Natural Resources	4	4
H. Educational Opportunities	5	
J. Environmental Pollution		4
K. Health Care		3

http://chemconnections.org/general/chem108/How%20Exercise%20Could%20Help%20You%20Learn-%20NYT.pdf

Could cycling improve your grade in Chem 106?

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0177624

Air bicycling?



https://calisthenics.github.io/exercise/bicycle/

August 28, 2017

Take out your i-clicker or smart phone and turn it on.

Look for your name on the screen; if dimmed, you are already registered. If not:

1. Click the i-clicker with the 3 letters below your name slowly in the order that they are listed
2. If you make an error and register someone else's name enter DD and re-enter with your name
3. If using a smartphone SELECT CHEM 106 and click the "join" link

You're i-clicker should be registered (Your name dims and i-clicker # appears); this process will not need to be repeated again. Bring your i-clicker to every class/lab meeting for credit

August 28, 2017

QUESTION

The difference between a scientific law and a scientific theory can, at times, be confusing. For example, we will refer to the "Atomic theory" or perhaps the "Law of Gravity." Should the Law of Gravity be changed to the Theory of Gravity?

A. Yes, no one can see gravity, it is better described as a theory.
B. No, scientific laws are based on summaries of many observations and gravity observations are well known and predictable. More than one theory may explain the observations.
C. Yes, gravity is better described as a theory because gravity explains why masses attract each other and theories are about explaining observations.
D. No, keep it as a law, laws offer explanations and gravity explains why masses attract each other and laws are about explaining observations.

Answer

The difference between a scientific law and a scientific theory can, at times, be confusing. For example, we will refer to the "Atomic theory" or perhaps the "Law of Gravity." Should the Law of Gravity be changed to the Theory of Gravity?

A. Yes, no one can see gravity, it is better described as a theory.
B. No, scientific laws are based on summaries of many observations and gravity observations are well known and predictable. More than one theory may explain the observations.
C. Yes, gravity is better described as a theory because gravity explains why masses attract each other and theories are about explaining observations.
D. No, keep it as a law, laws offer explanations and gravity explains why masses attract each other and laws are about explaining observations.

QUESTION

Identify the best match between the dimension or quantity and the unit that is most likely to be measured in Chem 106 lab.

	Dimension or Quantity	Unit
A)	Mass	Kilogram
B)	Length	Meter
C)	Volume	Milliliter
D)	Temperature	Fahrenheit
E)	Amount of substance	Megamole

Answer

Identify the best match between the dimension or quantity and the unit that is most likely to be measured in Chem 106 lab.

	Dimension or Quantity	Unit
A)	Mass	Kilogram
B)	Length	Meter
C)	Volume	Milliliter
D)	Temperature	Fahrenheit
E)	Amount of substance	Megamole

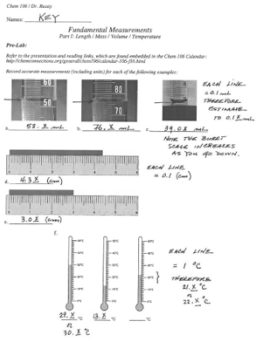
Chem 106: Class/ Lab

Week 3

Correct Measurements: Written Numbers & Units

Significant Figures

Fundamental Measurements Pre-lab
Part 1: Mass/ Volume/ Temperature



52.6 mL
Sig fig?
3

4.30 cm
Sig fig?
3

0.0430 m
Sig fig?
3

39.05 mL
Sig fig?
4

13.0 °C
Sig fig?
3

QUESTION

Which one of the following does NOT represent four significant digits?

A. 0.07100 mg
B. 0.7100 mg
C. 0.7010 mg
D. 0.0710 mg

Answer

Which one of the following does NOT represent four significant digits?

A. 0.07100 mg
B. 0.7100 mg
C. 0.7010 mg
D. 0.0710 mg

The zero in front of the decimal point is not a part of any measurement, the next zero is a place holder, and the last zero is part of the measurement and significant. Therefore 3 sig figs.

QUESTION

In which of these measured values are the zeros not significant figures?

I) 0.0591 cm
II) 504 g
III) 2.70 m
IV) 5300 L

A) I and II **B) II and III** **C) I and IV**

D) I, III, and IV **E) II, III, and IV**

Answer

In which of these measured values are the zeros not significant figures?

I) 0.0591 cm
II) 504 g
III) 2.70 m
IV) 5300 L

A) I and II **B) II and III** **C) I and IV**

D) I, III, and IV **E) II, III, and IV**

Chem 106: Class/ Lab

Week 3

Correct Measurements: Written Numbers & Units

Scientific Notation

Fundamental Measurements Pre-lab
Part 1: Mass/ Volume/ Temperature

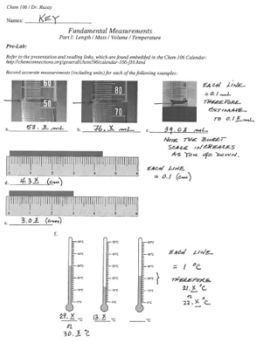
52.6 mL
Sci. Not.?

5.26×10^{1} mL

4.30 cm
Sci. Not.?
4.30 cm

0.0430 m
Sci. Not.?

4.30×10^{-1} m



Scientific Notation

- *Short Hand expression:*
  Powers of Ten / Exponents of base Ten
- *Count decimal places: to right (+) and to the left (-)* $1{,}000{,}000{,}000\ kg/m^3 = 1 \times 10^{9}\ kg/m^3$
  $0.00000018\ kg/cm^3 = 1.8 \times 10^{-7}\ kg/cm^3$
- *Multiplication: add exponents*
- *Division: subtract exponents*

Chem 106: Class/ Lab

Week 3

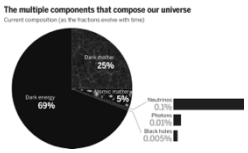
Correct Measurements: Written Numbers & Units

Significant Figures & Scientific Notation

Calculations

Percent & Ratio Comparisons

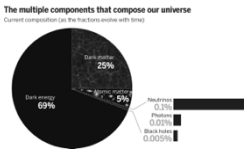
QUESTION



The estimated total mass of observable ordinary atomic matter in the universe is 10^{53} kg. Based on this estimate, the amount of dark matter is:

A. 25×10^{53} kg
B. 10^{265} kg
C. 5×10^{53} kg
D. 1×10^{53} kg
E. 30×10^{53} kg

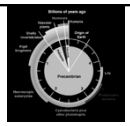
Answer



The estimated total mass of observable ordinary atomic matter in the universe is 10^{53} kg. Based on this estimate, the amount of dark matter is:

A. 25×10^{53} kg
B. 10^{265} kg
C. 5×10^{53} kg = (25%/ 5%) x 10^{53}
D. 1×10^{53} kg
E. 30×10^{53} kg

QUESTION



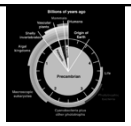
The earth is 4.54 billion years old and assume that our average lifespan will be 80 years. If the total age of the earth is represented by the face of a clock, how much time will 80 years be represented on the clock?

A) 0.001520 seconds **B) 0.00076 seconds**

C) 0.0008 seconds **D) 7,600,000 seconds**

E) 15,200,000,000 seconds

Answer



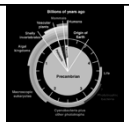
Assume that the earth is 4.54 billion years old and that your average lifespan will be 80 years. If the total age of the earth is represented by the face of a clock, how much time will 80 years be represented on the clock?

$$\frac{80\ \text{years}}{4{,}540{,}000\ \text{years}} = \frac{?\ \text{hrs}}{12\ \text{hrs}}$$

$$\frac{80\ \text{years} \times 12\ \text{hrs}}{4{,}540{,}000\ \text{years}} = ?\ \text{hrs}$$

$= 0.000000211\ \text{hrs} \rightarrow ?\ \text{sec}$

Answer



Assume that the earth is 4.54 billion years old and that your average lifespan will be 80 years. If the total age of the earth is represented by the face of a clock, how much time will 80 years be represented on the clock?

A) 0.001520 seconds (1.520 milliseconds)

B) 0.00076 seconds (0.76 milliseconds)
C) 0.0008 seconds (8 x 10^{-4} seconds; 0.76 milliseconds)

D) 7,600,000 seconds (7.6 megaseconds)

E) 15,200,000,000 seconds (15.2 gigaseconds)

0.000000211 hr x 60 min/hr x 60 sec/min = ? sec

Chem 106: Class/ Lab

Week 3

Correct Measurements: Written Numbers & Units
Significant Figures & Scientific Notation

Calculations
Percent & Ratio Comparisons

Conversions
Ratio Comparisons

QUESTION

Select the correct relationship between these metric units of length or distance.

A) 1 km = 100 m **B) 1 mm = 10 cm**

C) 1 nm = 10^9 m **D) 10^3 mm = 1 m**

Metric Prefixes

Prefix	Symbol	Multiple/Fraction
giga-	G	$1{,}000{,}000{,}000 = 1 \times 10^9$
mega-	M	$1{,}000{,}000 = 1 \times 10^6$
kilo-	k	$1{,}000 = 1 \times 10^3$
Basic unit: meter, gram, liter, second		
deci-	d	$0.1 = 1 \times 10^{-1}$
centi-	c	$0.01 = 1 \times 10^{-2}$
milli-	m	$0.001 = 1 \times 10^{-3}$
micro-	μ*	$0.000\,001 = 1 \times 10^{-6}$
nano-	n	$0.000\,000\,001 = 1 \times 10^{-9}$

Answer

Select the correct relationship between these metric units of length or distance.

A) 1 km = 100 m **B) 1 mm = 10 cm**

C) 1 nm = 10^9 m **D) 10^3 mm = 1 m**

Metric Prefixes

Prefix	Symbol	Multiple/Fraction
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Basic unit: meter, gram, liter, second		
deci-	d	$0.1 = 1 \times 10^{-1}$
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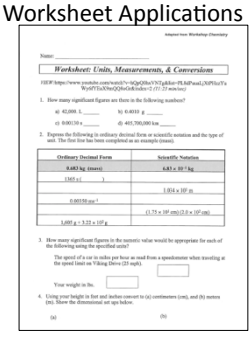
milli-	m	$0.001 = 1 \times 10^{-3}$
micro-	μ*	$0.000\,001 = 1 \times 10^{-6}$
nano-	n	$0.000\,000\,001 = 1 \times 10^{-9}$

Worksheet Applications



Worksheet: Units, Measurements, & Conversions

Worksheet Applications

Computational Rules

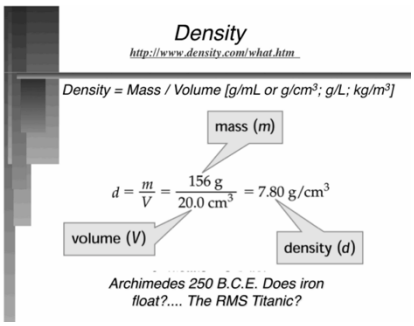
- *Addition/Subtraction: Answer expressed to the least number of decimal places of the figures in the process*
- *Multiplication/Division: Answer expressed to the least number of significant figures*

Chem 106 Lab: Week 3

Using the corrected Fundamental Measurements Pre-lab pg. 5 key as a foundation

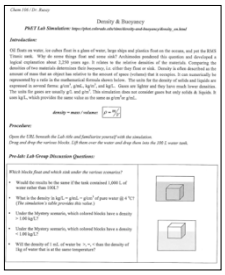
Complete the boiling point determination & liquid's mass & volume (Course/ Lab Manual pp. 7-8).
Turn in pp. 7-8 @ the end of today's lab if not turned in last week.

Chem 106 Lab: Week 3 & Week 4

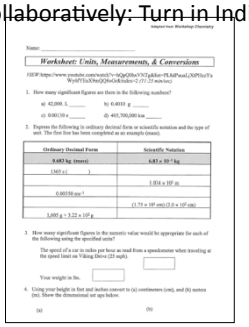


Chem 106 Lab

Consult with your Lab partner and any other Lab group with the opposite numbered unknown: *odd vs. even*; answer the 5 bulleted questions. Put your names on page #12 and have stamped by Dr. R. before leaving lab.



Worksheet: Due next Lab
Work Collaboratively; Turn in Individually



Worksheet: Units, Measurements, & Conversions

Write your name, then list the name(s) in parentheses of anyone who you worked with in doing the worksheet

Chem 106: Class/ Lab

[In-lab ASSIGNMENTS TODAY]

Fundamental Measurements: Turn in completed experiment, one submission per pair: Course/ Lab Manual pp. 7-8 if not done last week

Density Simulation Pre-lab (Course/ Lab Manual pg. 11: Collaborative) DUE end of Lab Today (Turn in one per collaborative group.)

Worksheet: Units, Measurements, & Conversions (Course/ Lab Manual pp. 3-4) In lab collaboration today. Turn in completed Worksheet individually next week.

Chem 106: Class/ Lab

Test Yourself

Correct Measurements: Written Numbers & Units
Significant Figures & Scientific Notation

Calculations
Percent & Ratio Comparisons

Conversions
Ratio Comparisons

QUESTION

Coincidentally, a U.S. nickel has a mass of approximately 5 grams. If you had one dollar's worth of nickels in your jean's what would be the mass of the nickels in milligrams?

A. 100 milligrams
B. 50 milligrams
C. 1,000 milligrams
D. 100,000 milligrams

1000 milligrams (mg) = 1 gram (g)

Answer

Coincidentally, a U.S. nickel has a mass of approximately 5 grams. If you had one dollar's worth of nickels in your jean's what would be the mass of the nickels in milligrams?

A. 100 milligrams
B. 50 milligrams
C. 1,000 milligrams
D. 100,000 milligrams

20 nickels make up one dollar, then one dollar's worth of nickels would have a mass of 5g x 20=100 grams. Next, the conversion between grams and milligrams is done by multiplying by 1,000 (because there are 1,000 milligrams per 1 gram.)

Would the weight of the nickels pull your jean's down off of your waist?

Answer

Coincidentally, a U.S. nickel has a mass of approximately 5 grams. If you had one dollar's worth of nickels in your jean's what would be the mass of the nickels in milligrams?

A. 100 milligrams
B. 50 milligrams
C. 1,000 milligrams
D. 100,000 milligrams

20 nickels make up one dollar, then one dollar's worth of nickels would have a mass of 5g x 20=100 grams. Next, the conversion between grams and milligrams is done by multiplying by 1,000 (because there are 1,000 milligrams per 1 gram.)

Would the weight of the nickels pull your jean's down off of your waist?
Likely not. 100g = 100g/454 g/lb equals 0.22lb ~ the weight of a quarter pounder

QUESTION

Science, 317, 765-775, (2007)
"The Electron Stopwatch"

An array of multilayer mirrors compresses ultrabroadband laser pulses (orange beam). The attosecond x-ray pulses allow the real-time observation of atomic-scale electron motion. The previous spectroscopic method was on a femtosecond scale, which was too slow to capture the movement.

How many times faster is attosecond spectroscopy compared to femtosecond methods?

A. 10x B. 100x C. 1,000x D. 1,000,000x

QUESTION

Science, 317, 765-775, (2007)
"The Electron Stopwatch"

How many times faster is attosecond spectroscopy compared to femtosecond methods?

Table: SI prefixes

Factor	Name	Symbol	Factor	Name	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zetta	Z	10^{-2}	centi	c
10^{18}	exa	E	10^{-3}	milli	m
10^{15}	peta	P	10^{-6}	micro	μ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	pico	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hecto	h	10^{-21}	zepto	z
10^{1}	deka	da	10^{-24}	yocto	y

A. 10x B. 100x C. 1,000x D. 1,000,000x

Answer

Science, 317, 765-775, (2007)
"The Electron Stopwatch"

How many times faster is attosecond spectroscopy compared to femtosecond methods?

Table: SI prefixes

Factor	Name	Symbol	Factor	Name	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zetta	Z	10^{-2}	centi	c
10^{18}	exa	E	10^{-3}	milli	m
10^{15}	peta	P	10^{-6}	micro	μ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	pico	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hecto	h	10^{-21}	zepto	z
10^{1}	deka	da	10^{-24}	yocto	y

10^{-15} / 10^{-18} = femto / atto

A. 10x B. 100x C. 1,000x D. 1,000,000x

~ "magnification"

QUESTION

If you were unloading a 23.50 kg box of books from your car and a "friend" added two more 482 gram chemistry books, how much in kg and using the rules for significant digits, would you be lifting?

A. 23.98 kg
B. 24.464 kg
C. 24.46 kg
D. 24.5 kg

Answer

If you were unloading a 23.50 kg box of books from your car and a "friend" added two more 482 gram chemistry books, how much in kg and using the rules for significant digits, would you be lifting?

A. 23.98 kg
B. 24.464 kg
C. 24.46 kg
D. 24.5 kg

The 482 grams of mass must be doubled (to include both books) and 482 grams is 0.482 kg. When adding measurements the answer has the same number of decimal places as the fewest decimal places in the calculation. Therefore the answer has 2 decimal places.

QUESTION

The average mass of a certain brand of vitamin C tablets is 253 mg. What is the mass of three such tablets rounded to the proper number of significant digits?

A. 0.760 grams
B. 0.759 grams
C. 0.7590 grams
D. 0.253 grams

Answer

The average mass of a certain brand of vitamin C tablets is 253 mg. What is the mass of three such tablets rounded to the proper number of significant digits?

A. 0.760 grams
B. 0.759 grams
C. 0.7590 grams
D. 0.253 grams

3 tablets × 253 milligrams = 759 milligrams, then dividing by 1,000 converts the milligrams to grams. Note the three is a count of the number of objects, not a measured quantity and 759 retains the same number of significant digits as the least found in related measurements.