Welcome to our CHEM 4 lecture

Review clicker question: Units raised to a power

Go to LearningCatalytics.com Session ID =

1) The vehicle assembly building at Kennedy Space Center is one of the largest buildings in the world with a volume of 3,666,500 m^3. How many gallons of water could fit in this building?

A) 9.6869×10^8 gal
B) 9.6869 gal
C) 968690000 gal
D) 96870 gal
E) 96869 gal
F) 9.687×10^8 gal
G) 9.6869×10^{-4} gal
H) 9.687×10^4 gal

Answer: Flowchart: $m^3 \rightarrow cm^3 \rightarrow L \rightarrow gal$

This is from cubing: 1 cm = 10^{-2} m

Calculation: $(3{,}666{,}500\ m^3)\left(\frac{1\ cm^3}{10^{-6}\ m^3}\right)\left(\frac{1\ L}{1000\ cm^3}\right)\left(\frac{1\ gal}{3.785\ L}\right) = 968692206 =$ **9.687×10^8 gal**

5sf *∞ sf* *∞ sf* *4sf*

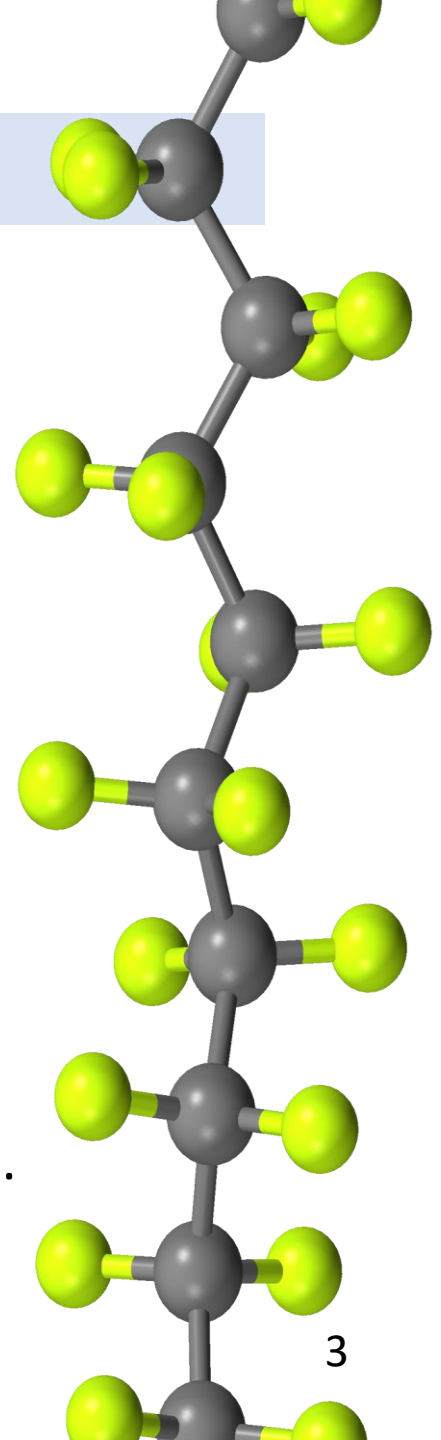
Keep 4sf. Use scientific notation to avoid ambiguous zeros.

- ✓ Today is the last day to register to vote in the November election.
- ✓ You can register to vote, check your registration status, and get info on upcoming elections including the various mechanism for voting at: www.sos.ca.gov/elections

- ✓ More information: Hornets vote! Hornets count!
- ✓ Among many important issues that will be impacted by our election results is how the United States addresses climate change.
- ✓ I recorded our missed climate change lecture and posted it along with other climate resources on our class website: tinyurl.com/SacStateChem4

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 (they are posted on the above website in the calendar section)
- ✓ 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.
- ✓ **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.



Prerequisites for CHEM 1A/1E

Students can meet the *chemistry prerequisite* in any of the following ways:

- ~~Having a Chemistry Diagnostic Score of 35 or higher.~~ (not available during COVID)
- Completed CHEM ALEKS (CARA) with 85% of the topics completed.
- Passing CHEM 4 or CHEM 6A with a ***grade of C or better***.
- Having obtained D to a C- in CHEM 4 AND completing 85% or the topics successfully in CARA.

Students can meet the *math prerequisite* in any of the following ways:

Math Prerequisite for CHEM 1A:	**Math Prerequisite for CHEM 1E:**
• A Math ALEKS PPL Score of 61 or higher • Successful completion of Math 12 or the equivalent • Current enrollment in Math 26A, Math 29 or a higher • Score of a 3 or higher on AB or BC Calculus AP Test • Ability to enroll in Math 26A or Math 29	• A Math ALEKS PPL score of 76 or higher • Successful completion of Math 29 or equivalent • Enrollment in a math course of Math 30 or higher • Score of a 3 or higher on AB or BC Calculus AP Test

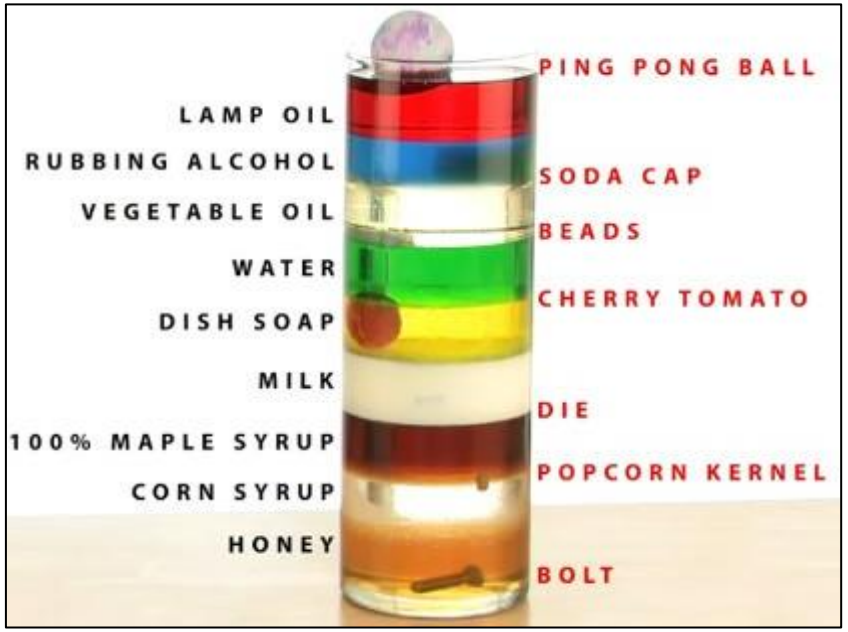
- Questions can be directed to **Dr. Susan Crawford (crawford@csus.edu)** or **Dr. Roy Dixon (rdixon@csus.edu)**
- Chem department: https://www.csus.edu/college/natural-sciences-mathematics/chemistry/
- Math dept ALEKS PPL: https://www.csus.edu/college/natural-sciences-mathematics/math-placement-exam/

CHEM 4 lecture

Monday – October 19, 2020

Sec 2.10 – 2.11

Density



Reading clicker question: Density

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2) Which of the following perfect cubes has the highest density? A cube that…

A) has a mass of 10 g and is 1 cm on each side.

B) has a mass of 0.1 g and is 0.1 cm on each side.

C) has a mass of 100 g and is 10 cm on each side.

D) has a mass of 10,000 g and is 10 cm on each side.

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{\text{mass}}{\text{l x w x h}}$$

$$\text{Density for B)} = \frac{0.1\ \text{g}}{(0.1\ \text{cm})(0.1\ \text{cm})(0.1\ \text{cm})} = \frac{0.1\ \text{g}}{0.001\ \text{cm}^3} = 100\ \text{g/cm}^3$$

Progress clicker question: Calculating density
Go to LearningCatalytics.com Session ID =

3) A 17.3-kg sample of unknown metal is found to displace 0.58 gallons of water when submerged. Based only on this information, what is most likely identity of the metal?

A) aluminum, density = 2.70 g/cm^3

B) iron, density = 7.86 g/cm^3

C) lead, density = 4.50 g/cm^3

D) platinum, density = 21.4 g/cm^3

Answer: The units of density in our answers are g/cm^3, so if we convert our mass to g and our volume to cm^3, we can find the density of our unknown metal in g/cm^3.

1) Convert kg $\rightarrow$ g: $(17.3\ \cancel{\text{kg}})\left(\frac{10^3\ \text{g}}{1\ \cancel{\text{kg}}}\right) = 17{,}300\ \text{g}$

3sf *∞ sf*

2) Convert gal $\rightarrow$ L $\rightarrow$ cm^3: $(0.58\ \cancel{\text{gal}})\left(\frac{3.785\ \cancel{\text{L}}}{1\ \cancel{\text{gal}}}\right)\left(\frac{1000\ \text{cm}^3}{1\ \cancel{\text{L}}}\right) = 2{,}195.3\ \text{cm}^3$

2 sf *4 sf* *∞ sf*

3) Find density: $\left(\frac{17{,}300\ \text{g}}{2{,}195.3\ \text{cm}^3}\right) = 7.8805\ \text{g/cm}^3 = 7.9\ \text{g/cm}^3$

Keep 2 sf

The closest value to our measurement is iron.

Background: Density

Density is a…

- **Physical property** – it doesn't make a new substance when you measure density.
- **Intrinsic property** – it doesn't matter how much of the sample you have. As mass ↑, the volume also ↑ proportionally, so the ratio of mass/volume is a constant for a given substance.
- Can look up values in table:
- Be careful: ice vs water
- If your flowchart has mass and volume, that is your clue that you need the density. If it isn't included in the question, then they are expecting you to look it up.
- g/cm^3 are common units, but different tables may have different units so always check.

Substance	Density (g/cm^3)
charcoal, oak	0.57
ethanol	0.789
ice	0.92
water	1.0
glass	2.6
aluminum	2.7
titanium	4.50
iron	7.86
copper	8.96
lead	11.4
gold	19.3
platinum	21.4

Background: Performing calculations that use density

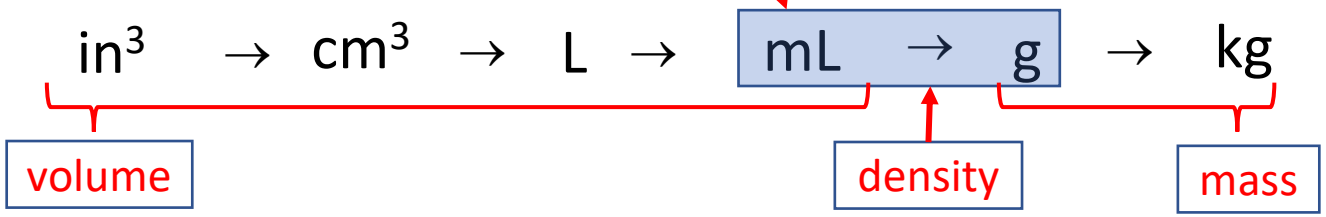
Example: Calculate the mass (in kg) of a Zn cube having a volume of 15.00 in^3. The density of zinc =7.14 g/mL

In order to use the density, I have to get my volume to mL.

Because our flowchart has volume and mass, we'll need the density. Check the density units to help guide your flowchart.

Answer:

Flowchart:



Calculation:

$$(15.00\ \text{in}^3)\left(\frac{16.387\ \text{cm}^3}{1\ \text{in}^3}\right)\left(\frac{1\ \text{L}}{1000\ \text{cm}^3}\right)\left(\frac{1\ \text{mL}}{10^{-3}\ \text{L}}\right)\left(\frac{7.14\ \text{g}}{1\ \text{mL}}\right)\left(\frac{1\ \text{kg}}{10^3\ \text{g}}\right) = 1.7550477\ \text{kg} = \mathbf{1.76\ kg}$$

4 sf *∞ sf* *∞ sf* *∞ sf* *3 sf* *∞ sf* *Keep 3sf*

Progress clicker question: Performing calculations that use density

Go to LearningCatalytics.com Session ID =

4) The typical adult has 3.1 L of blood plasma. What is the mass (in lb) of blood plasma for an average adult? Density, blood plasma = 1.03 g/cm^3

A) 17.4 lb
B) 22 lb
C) 21.8 lb
D) 7.04 lb
E) 17 lb
F) 7.0 lb

Answer:

Flowchart: L $\rightarrow$ cm^3 $\rightarrow$ g $\rightarrow$ lb

Calculation:

$$(3.1\ \text{L})\left(\frac{1000\ \text{cm}^3}{1\ \text{L}}\right)\left(\frac{1.03\ \text{g}}{1\ \text{cm}^3}\right)\left(\frac{1\ \text{lb}}{453.6\ \text{g}}\right) = 7.039241623 = \mathbf{7.0\ lb}$$

2 sf *∞ sf* *3 sf* *4 sf* *Keep 2sf*

Progress clicker question: Performing calculations that use density
Go to LearningCatalytics.com Session ID =

5) You buy a small gold ingot with a volume of 200.0 mm^3. If you had \$500.00 to spend on the ingot, how much money do you have left over? The density of gold is 19.3 g/cm^3 and the price of gold is \$57.40 per gram.

A) \$ 65
B) \$ 184
C) \$ 222
D) \$ 278
E) \$ 316
F) you don't have enough \$ to buy it

Answer: Flowchart: $mm^3 \rightarrow m^3 \rightarrow cm^3 \rightarrow g \rightarrow \$$

Calculation, \$ spent: $(200.0\ \cancel{mm^3})\left(\frac{10^{-9}\ \cancel{m^3}}{1\ \cancel{mm^3}}\right)\left(\frac{1\ \cancel{cm^3}}{10^{-6}\ \cancel{m^3}}\right)\left(\frac{19.3\ \cancel{g}}{1\ \cancel{cm^3}}\right)\left(\frac{\$\ 57.40}{1\ \cancel{g}}\right) = \$\ 221.564$

4 sf *∞ sf* *∞ sf* *3 sf* *4 sf* *Keep 3 sf*

Calculation, \$ left over: $\$500.00 - \$\ 221.564 = \$\ 278.436 =$ **\$ 278**

100ths *ones place* *Keep the ones place*