[TP] If all of the air in SCI/109 were condensed to liquid, how many 5-gallon containers would be required to hold the liquid air?
This is just an initial guesstimate (no "wrong" answer!)

20% 1. Much less than 1
20% 2. About 1
20% 3. About 5
20% 4. About 10
20% 5. Much more than 10

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Lecture 1 CH101 A1 (MWF 9:05 am)

Wednesday, September 5, 2018

For today ...

- Review of some course details
- How to approach the course
- How many atoms could be packed in SCI/109?
- Liquid volume of gas particles in SCI/109?

Next lecture: Continue ch2, 2.8—2.11: Atomic mass unit u; isotopes → atomic weight

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CH101 General Chemistry 1 overview

- quantum.bu.edu/courses/ch101-fall-2018
- Dan Dill (and Binyomin Abrams and Rosina Georgiadis)
- Piazza forum: piazza.com/bu/fall2018/ch101fall2018
- Office hours in SCI/200B (Atrium Area); see quantum.bu.edu/courses/ch101-fall-2018/help.html; me TW 4 pm

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No electronic devices

Except for your calculator and clicker, we require that no electronic devices (cell phones, computers, tablets, etc.) may be used in lectures, discussions, and labs.

We do this to help you get the greatest benefit you are able to during classes.

All together now, let's put our phones in airplane mode, and then put them away!

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When things start

- Labs start week after next
- Lab lectures (pre-labs) start next week
- Discussions start this week (tomorrow and Friday)

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Exams

- Exam 1, Tuesday (Monday schedule), October 9, 6:30–8:30 pm
- Exam 2, Monday, October 29, 6:30–8:30 pm
- Exam 3, Monday (Thanksgiving recess week), November 19, 6:30–8:30 pm
- Lab exam, Monday, December 10, 6:30–8:30 pm
- Final exam day and time to be determined by the registrar

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No makeup exams. Missed exam counts as 0

Exam 1: Tuesday (Monday schedule), October 9, 6:30–8:30 pm only!

Exam 3: Monday, November 19, 6:30–8:30 pm only!

Final exam: only on day and time set by registrar

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Academic conduct

You are bound by the provisions of the academic conduct code,

http://goo.gl/k78iy

TL;DR: We treat cheating with zero tolerance.

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Scheduling questions

For discussion, please contact Natalya Bassina (with your class schedule)

nbassina@bu.edu, Room SCI/270A, Wednesday (today) 3:30–5

For pre-lab lecture and lab, please contact Alex Golger, golger@bu.edu,

Goal is to do your best

How to approach our course?

- Each lecture: Review, rewrite, fill in gaps (annotated online), making sure all is clear.
- Use worked examples in text for detailed practice.
- Use text index to locate material about which you have questions. http://quantum.bu.edu/courses/ch101-fall-2018/syllabus.html#eBook
- Complete each week's discussion plan over the weekend, bringing what is unclear to study groups and office hours.

Next lecture

Continue ch2, sections 2.8—2.11:

Atomic mass unit u

isotopes → atomic weight

Chemist's dozen: The mole

What to do before next lecture?

Prepare next lecture topics, using being able to do related example problems as a measure of focused progress.

For example:

EXERCISE 2.12—ISOTOPES

(a) Argon has three isotopes, in which the number of neutrons in the atoms are 18 (0.337% abundant), 20 (0.063% abundant), and 22, respectively. What are the mass numbers and symbols of these three isotopes? What is the percent abundance of the isotope whose atoms have 22 neutrons?

(b) Gallium has two isotopes: ^{69}Ga and ^{71}Ga. How many protons and neutrons are in the nuclei of each of these isotopes? If the percent abundance of ^{69}Ga is 60.1%, what is the percent abundance of ^{71}Ga?

What to do before next lecture?

Prepare next lecture topic, using being able to do related example problems as a measure of focused progress.

For example:

EXERCISE 2.13—MASS RATIOS OF ISOTOPES

From the relative atomic masses of the isotopes of magnesium, listed in Table 2.2, calculate the following:
(a) the ratio of the mass of a ^{24}Mg atom to the mass of a ^{12}C atom
(b) the ratio of the mass of a ^{26}Mg atom to the mass of a ^{12}C atom
(c) the ratio of the mass of a ^{26}Mg atom to the mass of a ^{24}Mg atom

What to do before next lecture?

Prepare next lecture topic, using being able to do related example problems as a measure of focused progress.

Study closely only what is necessary to help with preparation.

Avoid unrelated reading!

What to do before next lecture?

Enumerate what are the key concepts of lecture 1

Make sure you can present key parts of lecture 1 to study partners.

For example, what volume would the air in you dorm room occupy if it were liquefied?

How to approach calculations

A key skill you will develop in this course is understanding what is needed to be done, and then carefully carrying it out.

Let's illustrate this by working through two problems.

How many atoms could be packed in SCI/109?

How many atoms could be packed in SCI/109?

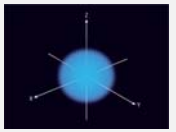
The stuff of our world is made of atoms

Really small: $\approx 10^{-8}$ cm diameter
(http://en.wikipedia.org/wiki/Atomic_radius)

Assume tightly packed (like a solid or a liquid)

Assume atoms are cubes, 10^{-8} cm on a side

Assume SCI/109 is 10 m wide, 5 m high, 40 m deep



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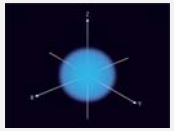
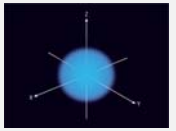


How many atoms could be packed in SCI/109?

Assume atoms are cubes, 10^{-8} cm on a side

Assume SCI/109 is 10 m wide, 5 m high, 40 m deep

Answer: $2 \times 10^{+33}$ atoms



Liquid volume of the air in SCI/109

If all of the air in SCI/109 were condensed to liquid, how many 5-gallon containers would be required to hold the liquid air?

Let's make an initial guesstimate (no "wrong" answer!)

[Quiz] If all of the air in SCI/109 were condensed to liquid, how many 5-gallon containers would be required to hold the liquid air?
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Liquid volume of the air in SCI/109

If all of the air in SCI/109 were condensed to liquid, how many 5-gallon containers would be required to hold the liquid air?

Volume of room & density of air → mass of air

Mass of air & density of liquid air → volume of liquid air

Liquid volume of the air in SCI/109

If all of the air in SCI/109 were condensed to liquid, how many 5 gallon containers would be required to hold the liquid air?

Volume of room & density of air → mass of air

Density of air at 20 °C is 1.2041 kg/m^3 (Google)

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Volume of room & density of air → mass of air

Density of air at 20 °C is 1.2041 kg/m^3 (Google)

Mass of air ≈ 2400 kg

Liquid volume of the air in SCI/109

If all of the air in SCI/109 were condensed to liquid, how many 5 gallon containers would be required to hold the liquid air?

Mass of air & density of liquid air → volume of liquid air

Air composition by mass is
75.5% N_2, 23.2% O_2, and 1.3% Ar (Google)

Liquid densities are
0.808 g/cm^3 N_2, 1.141 g/cm^3 O_2, 1.3954 g/cm^3 Ar (Google)

To keep the calculation simple, let's assume density of liquid air is about 1.0 g/cm^3

Liquid volume of the air in SCI/109

If all of the air in SCI/109 were condensed to liquid, how many 5 gallon containers would be required to hold the liquid air?

Mass of air ≈ 2400 kg

Liquid air density ≈ 1.0 g/cm^3

1 gal = 3785 cm^3