Lecture 1 CH101 A3 (TR 5 pm) Tuesday, September 4, 2012

Course details
• Electrons, protons & neutrons → atoms → stuff
• Mass spectra and isotopes
• Isotopes calculations → atomic weight

Next time: Complete ch 2: Chemist’s dozen: mole → counting by weighing. Prepare ch 3.1—3.6 and memorize fig 3.7 (p 50), fig 3.8 (p 51), table 3.2 (p 52)

No makeup exams!

Third lecture exam: Monday, November 19 only!
Final exam: Tuesday, December 18 only!

Order of topics
We will cover chapters 1—8 and 10 of Mahaffy et al., University

Doing calculations
We’ll learn how to do calculations by hand to one or two significant figures.
No calculators on quizzes or exams

Quizzes
• Each lecture, based on your preparation for the material to be covered during that lecture
• Administered using TurningPoint, so be registered before lecture 2:

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Course score

Your scores for each part of the course will always be available to you on learn.bu.edu at http://goo.gl/l1rBp

Also there you will find the running total of your overall course score

Course grade is based on your overall score

Course score

<table>
<thead>
<tr>
<th>Contribution to course score</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Lecture exams</td>
<td>30%</td>
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<tr>
<td>Final exam</td>
<td>15%</td>
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<tr>
<td>Laboratory</td>
<td>20%</td>
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<tr>
<td>Lecture quizzes</td>
<td>10%</td>
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<tr>
<td>Discussion quizzes</td>
<td>5%</td>
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<tr>
<td>OWL (online homework)</td>
<td>10%</td>
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<tr>
<td>ALEKS mastery</td>
<td>10%</td>
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</tbody>
</table>

Scheduling questions: Natalya Bassina

nbassina@bu.edu

SCI/270A Wednesday 3-6 pm

Work roadmap

- ALEKS (due Wednesdays) for initial preparation
- Work chapter problems and activities in detail before lecture
- Use OWL (due Sundays) to assess and refine basics skills
- Discussion for practice and further development
- Lab is integral to the course and its topics are on each exam
- Challenge problems will be assigned from time to time

Piazza is your primary resource for questions and answers http://goo.gl/rdI9q

Course expectations

1. What are your expectations form this course?

2. What makes for a good course?

Which of the following applies best to you?

0% 1. I have had some chemistry, but do not remember much.
0% 2. I am fairly comfortable with general chemistry from my high school course.
0% 3. I have never had a course in general chemistry.
Electrons, protons & neutrons \(\rightarrow\) atoms \(\rightarrow\) stuff

“Chemists communicate their observations and ideas with each other through words, labels, drawings and symbols to refer to particular events and substances”

The stuff of our world is made of atoms

Really small: \(\approx 10^{-8}\) cm diameter

How many atoms packed in SCI/109?

Atom: mostly wispy, nearly empty, cloud of negative charge (electrons)

Nucleus: \(\approx 10^{-12}\) cm diameter (typo) extraordinarily dense sphere of positive charge

Positive charge due to protons

Also neutral neutrons

Mass spectra and isotopes
Element identity and atomic number

Number of protons = atomic number $Z = 35$
Relative atomic weight = 79.904
Where does the number 79.904 come from?

Mass spectrometer “weighs” atoms

Strip away an electron, accelerate positive ions, and then deflect them in a magnetic field.
Less deflection, heavier mass
Neon has three “isotopes”: $^{20}\text{Ne}$, $^{21}\text{Ne}$ and $^{22}\text{Ne}$
Relative peak heights $\rightarrow$ isotopic abundance

[Quiz] The molar mass of Cl is 35.453 g. $^{37}\text{Cl}$ has a natural abundance of 24.24%. Which of the following statements is true?

0% 1. The mass of an atom of naturally occurring Cl is 35.453 g divided by Avogadro’s number
0% 2. The mass of an atom of naturally occurring Cl cannot be 35.453 g divided by Avogadro’s number.
0% 3. The mass of an atom of naturally occurring Cl is 35.453 g/0.2424 divided by Avogadro’s number.
0% 4. None of the statements is true.

Abundance of Br isotopes

webbook.nist.gov/chemistry: Two “isotopes”: $^{79}\text{Br}$ and $^{81}\text{Br}$
Relative height of $^{79}\text{Br}$ peak to $^{81}\text{Br}$ peak: 1.028
What is fractional abundance of $^{79}\text{Br}$ and $^{81}\text{Br}$?
1.028 = $^{79}\text{Br}/^{81}\text{Br} = (1 - ^{81}\text{Br})/^{81}\text{Br}$
2.028 $^{81}\text{Br} = 1$
1/2.028 = $^{81}\text{Br} = 0.4931$ and 1 – 0.4931 = $^{79}\text{Br} = 0.5069$

What is the relative atomic weight of Br?

$^{79}\text{Br} = 0.5069$ and $^{81}\text{Br} = 0.4931$
$^{79}\text{Br} = 78.918$ u and $^{81}\text{Br} = 80.916$ u
0.5069 x 78.918 + 0.4931 x 80.916 = 79.90
One last question...

Isotopologues!

What is responsible for the three peaks near 160?

Isotope calculations: Exercise 2.13

Ratio of mass of $^{24}\text{Mg}$ (A$_r$ = 23.9850) to mass of $^{12}\text{C}$?

Answer: 1.99875

Isotope calculations: Question 2.38

$^6\text{Li}$: A$_r$ = 6.015121, 7.50% and $^7\text{Li}$: A$_r$ = 7.016003.

What is Li atomic weight?

Answer: 6.941

Isotope calculations: Question 2.42

Of $^{39}\text{K}$, $^{40}\text{K}$ and $^{41}\text{K}$, $^{40}\text{K}$ has very low abundance.

Which of $^{39}\text{K}$ and $^{41}\text{K}$ is more abundant?

Use that $^{39}\text{K}$ A$_r$ = 38.964 and $^{41}\text{K}$ A$_r$ = 40.962 and that K atomic weight = 39.083

Answer: $^{39}\text{K}$ dominates (93.26%)

From data given, calculate the atomic weight.

Answer = 39.10