Give Them Time to Think: More Learning with Less Listening

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The Courses

- Modern Chemistry 1 (>200 students)
- Organic Chemistry 1 (100 students)

The Problem

- get active learning in large class!

(note: purple denotes notes added for purposes of website)

(large courses = those that you can't individually make eye contact with each student in every class)

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A potential solution

- use some classroom time as a tutorial

Method?

- think-group-share...
- ...peer teaching, students choose how much collaborating they do

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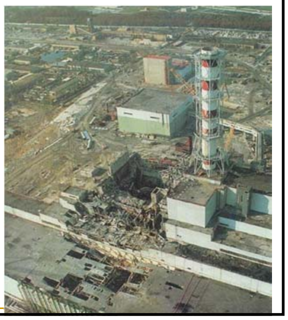
Chemistry 1110

Modern Chemistry I

Class #17 - Atomic Structure

Nuclear Reactions - Uses (19.4 - 19.7)

(this is an example of a class in Modern Chem I, heavily editted for time/space! text is Chemistry 8th edition, but Zumdahl and Zumdahl)



Half-life and Nuclear Decay

✯ nuclei decay at different rates

✯ rate is given by:

$$\ln\left(\frac{N}{N_0}\right) = -kt$$

N = # of nuclei left
N_0 = initial number
k = rate constant
t = time

(more details in Chapt. 12 - see CHEM 1130)

Half-life and Nuclear Decay

✯ half-life = length of time for 50% of the nuclei to decay

$$t_{1/2} = \frac{\ln 2}{k}$$

✯ by knowing the half-life (or *k*) we can calculate how old a sample of a radioactive element is

Half-life and Nuclear Decay

✯ radiodating measures residual radioactivity in sample

e.g., ^{14}C dating: radioactive CO_2 (made by solar radiation) absorbed by plants - once in plant no more fresh ^{14}C is made

✯ ^{14}C half-life is 5730 years

Exercise 1: The half-life of ^{232}Pu is 34.1 minutes. Calculate the decay constant, then calculate how long it would take 99% of a sample of ^{232}Pu to decay.

(the lecturing would have been ~15 minutes from beginning of class to this first example; note that the example is strictly based on the immediately preceding slides that were covered in that 15 minutes of class time)

Energy from nuclear reactions

- atomic nuclei have *less mass* than the sum of the particles making up the atom
- where does the mass go?

$E = mc^2$

- mass loss represents the energy holding the nucleus together

Atomic Structure VII: Nuclear Chemistry

Exercise 2: ^{12}C can be created in stars by the following process:

$$^{4}_{2}He + ^{8}_{4}Be \longrightarrow ^{12}_{6}C$$

Using these exact masses, calculate the energy of this reaction (remember, -ve is energy released)

^{4}He: 4.002603 g/mol
^{8}Be: 8.005305
^{12}C: 12.000000

(about another 10 min of class time has passed when this example appears)

Primary difficulty

- time!

Solution

- make the time!
  e.g., textbook pre-class readings

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Secondary difficulties

- noise / loss of control
- students don't do the exercise

Solution

- so what?

(the point here is that I believe it is the student's choice to take advantage of the learning activity, and I will not force them to partake if they choose not to)

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Chemistry 2211

Organic Chemistry I

Class #21

Nucleophilic addition to carbonyls

(18.2-18.8, 18.10)

(the 1st-year examples are strictly regurgitation of material just presented in class over the last 10-20 minutes; you'll see that is not the case in this upper-year course)

Carbonyls 5: nucleophilic additions

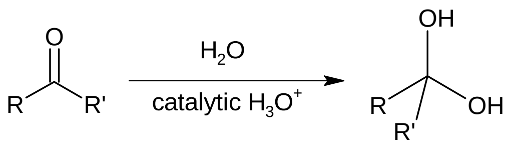
New reactions:

- aldehyde oxidation
- "reduction" with hydrazine
- nucleophilic additions (this class)

(a reminder of what we've recently covered)

Carbonyls 5: nucleophilic additions

(a) Acid catalysed hydration:

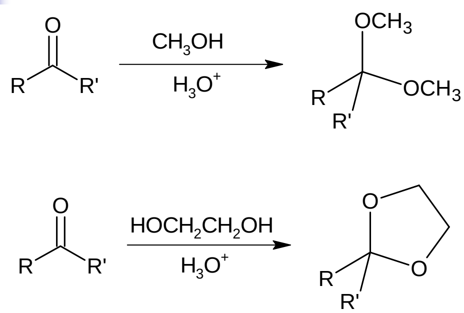


mechanism: section 18.7

also: addition of HCN

Carbonyls 5: nucleophilic additions

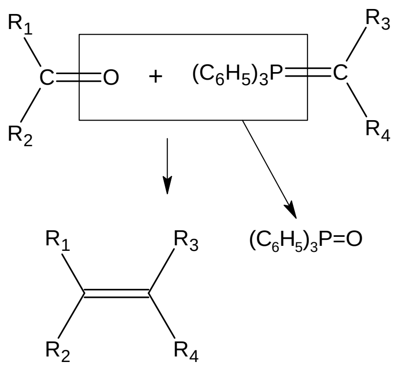
(b) Acetal = "addition" of (2) alcohols:



mechanism: p. 756

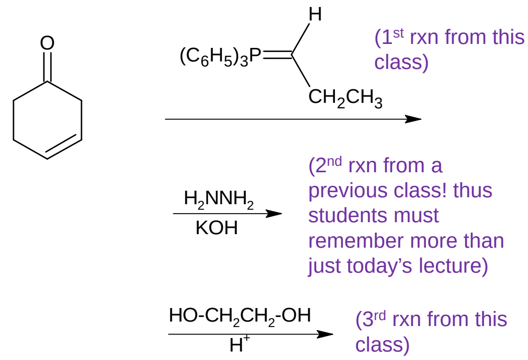
Carbonyls 5: nucleophilic additions

(c) Ylides (the Wittig reaction):



Carbonyls: exercises

Predict products for the following:



More learning with less listening

- use textbook to transmit information, use class time for active learning
- breaks up the lecturing, better focus
- no T.A.'s necessary! (but would be nice....)
- infinitely scalable
- best for classes with many small/short examples

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