Chem 1C Midterm 3

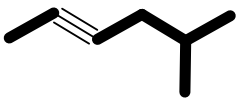
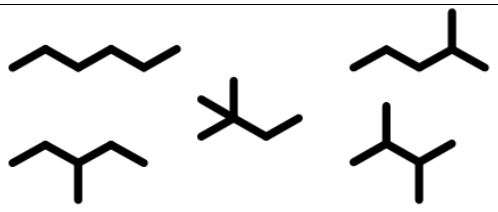
Practice Test

Credit will only be given for answers on this sheet. Units must be included in your answers and points will be taken off for incorrect or missing units. No partial credit will be awarded. Calculators are allowed. Cell phones may not be used as calculators.

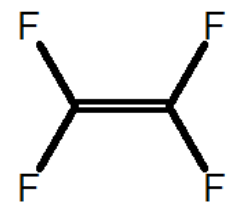
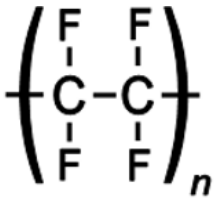
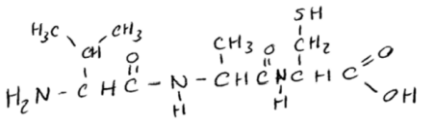
Name:	**Perm Number**

Make sure your writing is dark and large enough to be picked up by a scanner. Failure to do this results in the loss of 5 points on the exam.

If you are sitting next to someone with the same version of the test you both will lose 5 points.

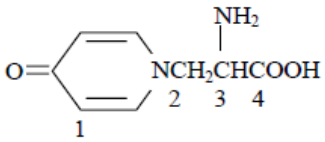
Fundamentals	
Question (Points)	**Answer**
1 (4 pts)	○ aldehyde ● carboxylic acid ● primary amine ○ tertiary alcohol ○ secondary amine ○ ester ● tertiary amine ● ketone
2 (6 pts) 2,2,2	3-bromo-7-proplycycloheptene
	
	2,6-dimethyloctane
3 (7 pts)	2.7 d
4 (7 pts)	$1.41 \times 10^{-12} \frac{J}{nucleon}$
5 (6 pts)	 None of these have geometric isomers
6 (6 pts) 3,3	$^{14}_{6}C \rightarrow {}^{0}_{-1}e + {}^{14}_{7}N$
	$^{180}_{74}W \rightarrow {}^{4}_{2}He + {}^{176}_{72}Hf$

Multiple Choice	
Question (Points)	**Answer**
7 (6 pts)	○ A ● B ○ C ○ D ○ E
8 (5 pts)	○ A ● B ○ C ○ D ○ E
9 (7 pts)	○ A ○ B ○ C ● D ○ E
10 (6 pts)	○ A ○ B ● C ○ D ○ E
11 (5 pts)	○ A ● B ○ C ○ D ○ E
12 (5 pts)	○ A ○ B ○ C ● D ○ E

Challenge Problems	
Question (Points)	**Answer**
13 (10 pts)	2.42631x10^{-3} nm
14 (20 pts) 6,4,6,4	 Tetrafluoroethylene  Teflon (repeating unit)
	● Addition Polymerization ○ Condensation Polymerization
	
	● Primary Structure ○ Secondary Structure ○ Tertiary Structure

Fundamental Questions

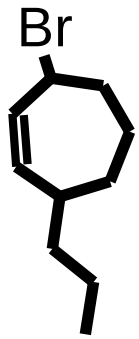
1) *4 pts* Consider the structure of mimosine shown below.



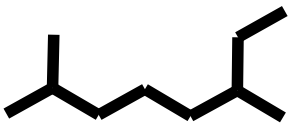
What functional groups are present?

aldehyde	alcohol tertiary	tertiary amine	carboxylic acid
secondary amine	ketone	primary amine	ester

2) *6 pts* Draw or name each of the following:



5-methyl-2-hexyne



3) *7 pts* A freshly isolated sample of ^{90}Y was found to have an activity of 9.8×10^{5} disintegrations per minute at 1:00 pm on December 3, 2000. At 2:15 pm on December 17, 2000, its activity was redetermined and found to be 2.6×10^{4} disintegrations per minute. Calculate the half-life of ^{90}Y.

4) *7 pts* Calculate the binding energy per nucleon $\left(\frac{J}{nucleon}\right)$ for ^{62}Ni ($m_{62_{Ni}} = 61.928\ u$)

5) *6 pts* Draw all of the structural isomers for C_6H_{14}. Circle those that can be geometric isomers.

6a) *3 pts* The carbon-14 nuclide radioactively decays by beta emission. Write a balanced nuclear chemical equation that describes this process.

6b) *3 pts* The tungsten-180 nuclide radioactively decays by alpha emission. Write a balanced nuclear chemical equation that describes this process.

Multiple Choice

7) *6 pts* The U-238 nucleus decays to form Pb-206 by α and β decays. Calculate the number of α decays.

a. 4
b. 8
c. 2
d. 6
e. None of these

8) *5 pts* The oxidation of secondary alcohols results in:

a. aldehydes
b. ketones
c. ethers
d. secondary alcohols
e. esters

9) *7 pts* One of the hopes for solving the world's energy problem is to make use of the fusion reaction

$$^{2}_{1}\text{H} + ^{3}_{1}\text{H} \rightarrow ^{4}_{2}\text{He} + ^{1}_{0}\text{n} + \text{energy}$$

How much energy is released when 1 mol of deuterium is fused with 1 mol of tritium according to the above reaction? The masses of the atoms and the neutrons are as follows:

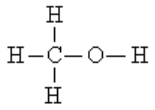
$$^{2}_{1}He = 2.0140\ amu\ ^{3}_{1}H = 3.01605\ amu$$
$$^{4}_{2}He = 4.002603\ amu\ ^{1}_{0}n = 1.008665\ amu$$

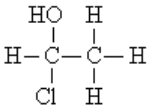
a. 7.84×10^{44} J
b. 5.63x108 J
c. 56.3 J
d. 1.69×10^{12} J
e. None of the above

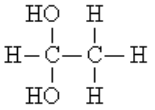
10) *6 pts* If a tree dies and the trunk remains undisturbed for 13,750 years, what percentage of the original ^{14}C is still present? (The half-life of ^{14}C is 5730 years.)

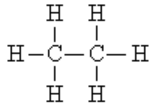
a. 45.0%
b. 5.20%
c. 19.0%
d. 2.20%
e. None of the above

11) *5 pts* Pick the optically active molecule among the following:

a.


b.


c.


d.


e. None of these are optically active

12) *5 pts* The most likely decay mode (or modes) of the unstable nuclide $^{11}_{6}C$ would be

a. α-particle production
b. β emission
c. Positron production
d. Either positron production or electron capture or both
e. Electron capture

Challenge Problems

13) *10 pts* A positron and an electron annihilate each other upon colliding, thereby producing energy:

$$_{-1}^{0}e + {}_{1}^{0}e \rightarrow 2\,{}_{0}^{0}\gamma$$

Assuming that both γ rays have the same energy, calculate the wavelength of the electromagnetic radiation produced.

14a) *6 pts* Teflon is made from the monomer tetrafluoroethene. Draw the structure for tetrafluoroethene and the repeating unit for Teflon.

Tetrafluoroethylene Teflon (repeating unit)

14b) *4 pts* Is the synthesis of Teflon an example of addition polymerization or condensation polymerization?

14c) *6 pts* Draw the structure for the tripeptide, Val-Ala-Cys, in that order.

14d) *4 pts* The analysis of a protein for its amino acid content is valuable in determining the protein's…

Primary Structure Secondary Structure Tertiary Structure