Chem 3C Midterm 3
Version B

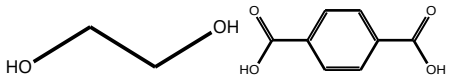
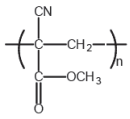
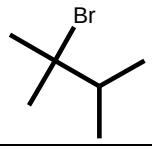
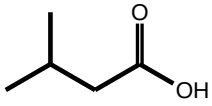
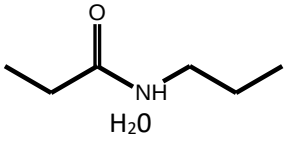
Credit will only be given for answers on this sheet. Units must be included in your answers and points will be taken off for incorrect or missing units. No partial credit will be awarded. Calculators are allowed. Cell phones may not be used as calculators.

Name:	**Perm Number**

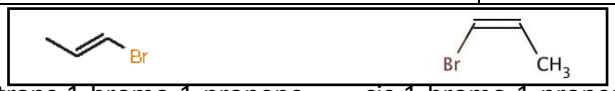
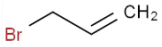
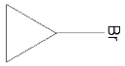
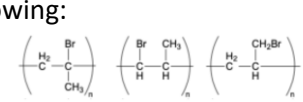
Make sure your writing is dark and large enough to be picked up by a scanner. Failure to do this results in the loss of 5 points on the exam.

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

If you are still writing after time is called, you will lose 5 points on the exam.

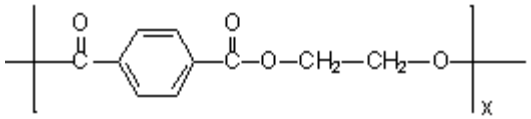
Fundamentals				
Question (Points)	**Answer**			
1 (8 pts) 4 each				
2 (6 pts) 1 each	Secondary Amine	○A ●B ○C ○D ○E ○F ○G ○H ○I ○J ○K ○L		
	Primary Alcohol	○A ○B ○C ○D ○E ○F ○G ○H ○I ○J ○K ●L		
	Carboxylic Acid	●A ○B ○C ○D ○E ○F ○G ○H ○I ○J ○K ○L		
	Ester	○A ○B ○C ○D ○E ○F ●G ○H ○I ○J ○K ○L		
	Aldehyde	○A ○B ○C ○D ○E ○F ○G ●H ○I ○J ○K ○L		
	Ether	○A ○B ○C ○D ○E ○F ○G ○H ●I ○J ○K ○L		
3 (7 pts)	26.99 u			
4 (4 pts) 2 each	alpha = 10		beta = 5	
5 (6 pts)	4.3x10^6 $\frac{kg}{s}$			
6 (6 pts) 2 each				

Multiple Choice	
Question (Points)	**Answer**
7 (6 pts) 3 each	○ A ● B ○ C ○ D ○ E ○ F ○ B ○ C ○ D ○ E ● A ○ B ○ A ● B ○ C
	○ A ○ B ● C ○ D ○ E ○ F ○ B ○ C ○ D ○ E ○ A ● B ○ A ○ B ● C
8 (5 pts)	○ A ● B ○ C ○ D ○ E
9 (5 pts)	○ A ● B ○ C ○ D
10 (6 pts)	○ A ○ B ○ C ● D ○ E
11 (6 pts) 1.5 each	○ A ● B
	○ A ● B
	○ A ● B
	○ A ● B
12 (6 pts) 2 each	● A ○ B ● C ○ D ● E
	● A ○ B ● C ○ D ○ E
	● A ○ B ○ C ● D ○ E

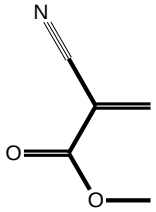
Challenge Problems			
Question (Points)	**Answer**		
13 (10 pts) 5 each	^{238}U = 76%	^{235}U = 24%	
14 (19 pts) 7,3,3,3,3	 trans-1-bromo-1-propene	 cis-1-bromo-1-propene	 2-bromo-1-propene
	 3-bromo-1-propene	 bromocyclopropane	
	Any of the following: 		
	$M_{polymer}$ = 965 $\frac{g}{mol}$	Monomers = 8	$P_{solution}$ = 0.0312 atm

Fundamental Questions

1a) *4 pts* What is/are the monomer(s) that the following polymer is made from?

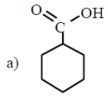


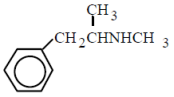
1b) *4 pts* "Super glue" contains methyl cyanoacrylate

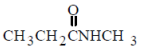


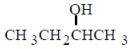
which readily polymerizes on exposure to traces of water or alcohols on the surfaces to be bonded together. The polymer provides a strong bond between the two surfaces. Draw the structure of the polymer formed by methyl cyanoacrylate.

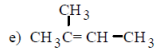
2) *6 pts* Match the functional group with the letter of the corresponding molecule.

a) 

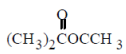
b) 

c) 

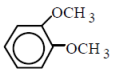
d) 

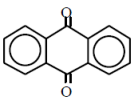
e) 

f) 

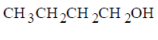
g) 

h) 

i) 

j) 

k) 

l) 

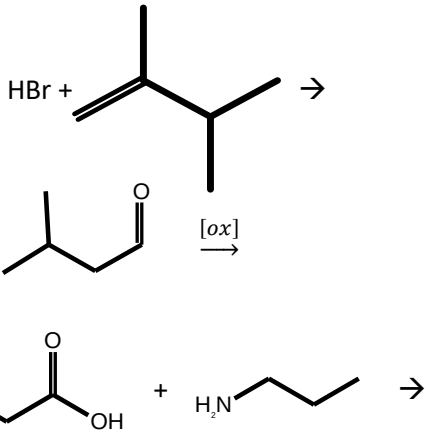
_____ secondary amine _____ primary alcohol _____ carboxylic acid
_____ ester _____ aldehyde _____ ether

3) *7 pts* The binding energy per nucleon of magnesium-27 is 1.326×10^{-12} $\frac{J}{nucleon}$. Calculate the atomic mass of the magnesium-27 (in amu)?

4) *4 pts* The radioactive isotope ^{247}Bk decays by a series of α-particle and β-particle productions, taking ^{247}Bk through many transformations to end up as ^{207}Pb. In the complete decay series, how many α particles and β particles are produced?

5) *6 pts* The sun radiates 3.9×10^{23} J of energy into space every second. What is the rate at which mass is lost from the sun?

6) *6 pts* What are the products of the following reactions?



Multiple Choice

7) *6 pts* The table below lists information about two common types of nuclear radiation. Fill in the missing information. Note: round masses to nearest atomic mass unit (u).

name	matter or energy?	mass (u)	charge (e)	can be stopped by
A. Alpha B. Beta C. Gamma E. Delta F. Omega G. Proton H. Neutron I. Positron J. Negatron	A. Matter B. Energy	0	-1	A. Sheet of paper B. Household wall C. Thick concrete wall
A. Alpha B. Beta C. Gamma E. Delta F. Omega G. Proton H. Neutron I. Positron J. Negatron	A. Matter B. Energy	0	0	A. Sheet of paper B. Household wall C. Thick concrete wall

8) *5 pts* How many of the following are optically active?

$NH_2CH(CH_3)COOH$ $C(CH_3)_4$

$(CH_3)_2C(NH_2)COOH$ NH_2CH_2COOH

$CH_3CHCH(Cl)$

A. 0
B. 1
C. 2
D. 3
E. 4

9) *5 pts* Which of the following processes does not help $^{145}_{64}Gd$ (proton rich) become more stable?

A. Electron Capture
B. Beta Particle Emission
C. Positron Emission
D. Proton Emission

10) *6 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:

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

A. 7.84×10^{44} J
B. 5.63×10^{8} J
C. 56.3 J
D. 1.69×10^{12} J
E. None of the above

11) *6 pts* Are the following named correctly?

2-fluoro-1-cholo-4,4-dimethyloctane
A. Correct
B. Incorrect

3,4-dichloropentane
A. Correct
B. Incorrect

cis-1,3-dimethylbutane
A. Correct
B. Incorrect

1-fluoro-2,4-methyl-3-ethylcyclohexane
A. Correct
B. Incorrect

12) *6 pts* Classify each of the chemical compounds:

Compound	type of compound *(check all the apply)*
CH_3CH_3	A. molecular B. ionic C. organic D. inorganic E. hydrocarbon
$CH_3(CH_2)_2OH$	A. molecular B. ionic C. organic D. inorganic E. hydrocarbon
NO	A. molecular B. ionic C. organic D. inorganic E. hydrocarbon

Challenge Problems

13) *10 pts* Naturally occurring uranium is composed mostly of ^{238}U and ^{235}U with relative abundances of 99.28% and 0.72%, respectively. The half-life for ^{238}U is 4.5×10^{9} years, and the half-life for ^{235}U is 7.1×10^{8} years. Assuming that the earth was formed 4.5 billion years ago (4,500,000,000 years), calculate the relative abundances of the ^{238}U and ^{235}U isotopes when the earth was formed.

14a) *7 pts* Draw and name all of the structural isomers of C_3H_5Br. Circle any structure that can have geometric isomers.

14b) *3 pts* Propose an addition polymer that can form using one of your structural isomers as the monomers. Draw the structure of the polymer.

14c) *3 pts* 100. g of the polymer in part b was mixed with enough water to make 500. mL of solution. If the osmotic pressure of the solution is 5.07 atm at 25˚C what is the average molar mass of the polymer?

14d) *3 pts* How many monomers constitute the "average" molecule?

14e) *3 pts* What would be the vapor pressure of the solution, if the vapor pressure of pure water at 25˚C is 0.0313 atm? Assume the density of the solution is 1.00 $\frac{g}{cm^3}$. (Assume that the polymer has negligible vapor pressure.)