

1st Letter of Last
Name

NAME:

610B Exam Cover Page

To be eligible for requesting a regrade, the exam must be written in *ink*.

No calculators of any sort allowed.

You have 3 hours to complete the exam.

CHEM 610B, 50995

Exam 1

Fall 2003

Instructor: Dr. Brian Pagenkopf

NAME: _____

Email: _____

Page	Points
2	5
3	6
4	10
6	10
8	5
9	4
10	4
11	9
12	9
13	6
14	9
15	3
16	8
17	8
18	2
19	2
	100

NAME: _____

Exam 1/610B/Pagenkopf

6 — Atomic number
C — Symbol
12.011 — Atomic mass

PERIODIC TABLE OF THE ELEMENTS

Atomic masses are based on ^{12}C . Atomic masses in parentheses are for the most stable isotope.

Groups																VIIIA			
Periods																2			
1																	2		
H																	He		
1.00079																	4.00260		
IIA														IIIA	IVA	VA	VIA	VIIA	
3	4													5	6	7	8	9	10
Li	Be													B	C	N	O	F	Ne
6.941	9.01218													10.81	12.011	14.0067	15.9994	18.998403	20.179
IIA														IIIA	IVA	VA	VIA	VIIA	
11	12													13	14	15	16	17	18
Na	Mg													Al	Si	P	S	Cl	Ar
22.98977	24.305													26.98154	28.0855	30.97376	32.06	35.453	39.948
IIA		IIIB	IVB	VB	VIB	VII B	VIIIB		IB	IIB	IIIA		IVA	VA	VIA	VIIA			
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
39.0963	40.08	44.9559	47.90	50.9415	51.996	54.9380	55.847	58.9332	58.70	63.546	65.38	69.72	72.59	74.9216	78.96	79.904	83.80		
IIA		IIIB	IVB	VB	VIB	VII B	VIIIB		IB	IIB	IIIA		IVA	VA	VIA	VIIA			
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
85.4678	87.62	88.9059	91.22	92.9064	95.94	(98)	101.07	102.9055	106.4	107.868	112.41	114.82	118.69	121.75	127.60	126.9045	131.30		
IIA		IIIB	IVB	VB	VIB	VII B	VIIIB		IB	IIB	IIIA		IVA	VA	VIA	VIIA			
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
132.9054	137.33	138.9055	178.49	180.9479	183.85	186.207	190.2	192.22	195.09	196.9665	200.59	204.37	207.2	208.9804	(209)	(210)	(222)		
IIA		IIIB	IVB	VB	VIB	VII B	VIIIB		IB	IIB	IIIA		IVA	VA	VIA	VIIA			
87	88	89	104	105	106														
Fr	Ra	Ac	Unq	Unp	Unh														
(223)	226.0254	227.0278	(261)	(262)	(263)														

*Lanthanide series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.12	140.9077	144.24	(145)	150.4	151.96	157.25	158.9254	162.50	164.9304	167.26	168.9342	173.04	174.967

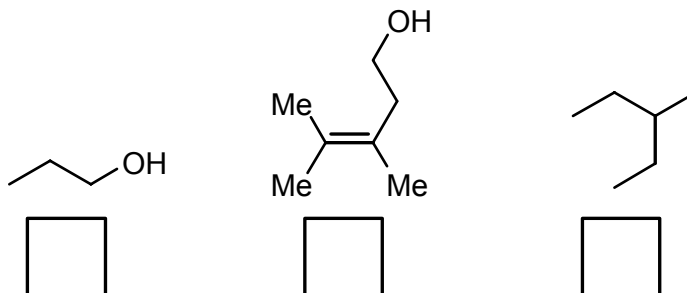
†Actinide series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
232.0381	231.0359	238.029	237.0482	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)

Question 1. (2 Points). What has the instructor said is the most important question in Organic Chemistry?

Question 2. Miscellaneous NMR questions.

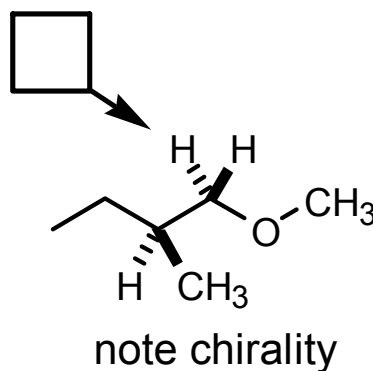
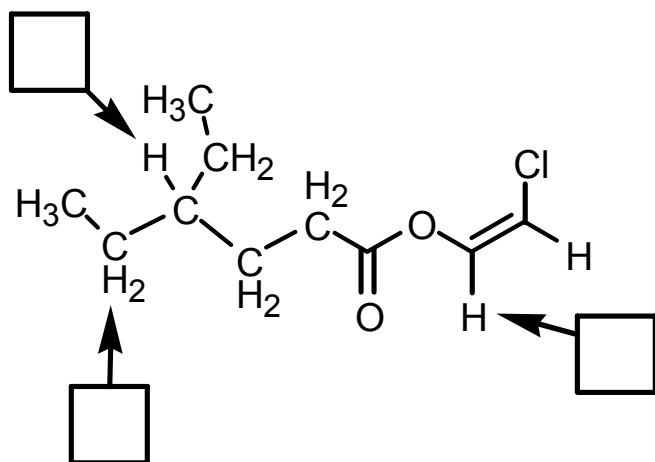
(3 points) In the box below each molecule, indicate how many sets of equivalent hydrogens the molecule has. Each set will give rise to a different resonance signal in the ^1H NMR spectra.



NAME: _____

Exam 1/610B/Pagenkopf

(4 points) Predict the splitting of the indicated hydrogens (i.e., dt or 2 x 3 for doublet of triplets).

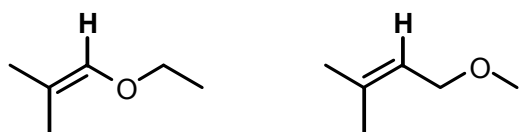


(2 points) For each pair of compounds, in which molecule would the **bolded** hydrogens resonate upfield (towards the right of the spectra, smaller ppm). Circle your answer.

a)



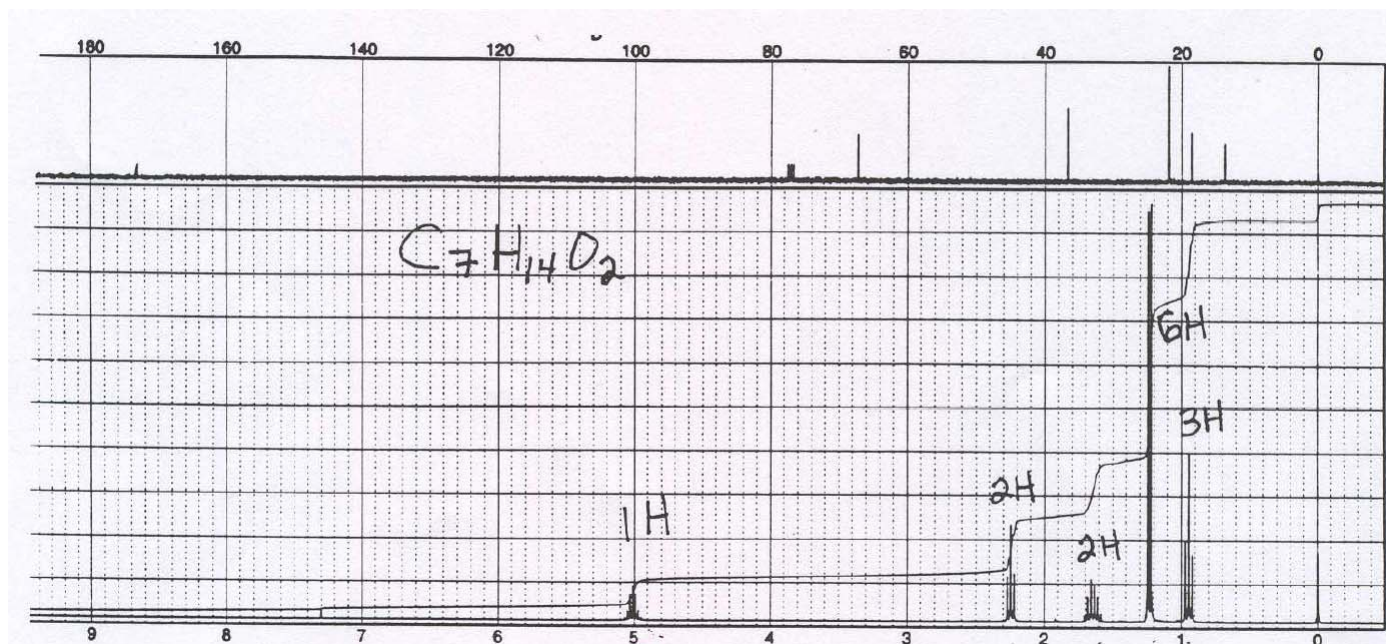
b)



NAME: _____

Exam 1/610B/Pagenkopf

(10 points) NMR. Propose a structural formula based on the following NMR information. Show your work, and account for the observed patterns of splitting.



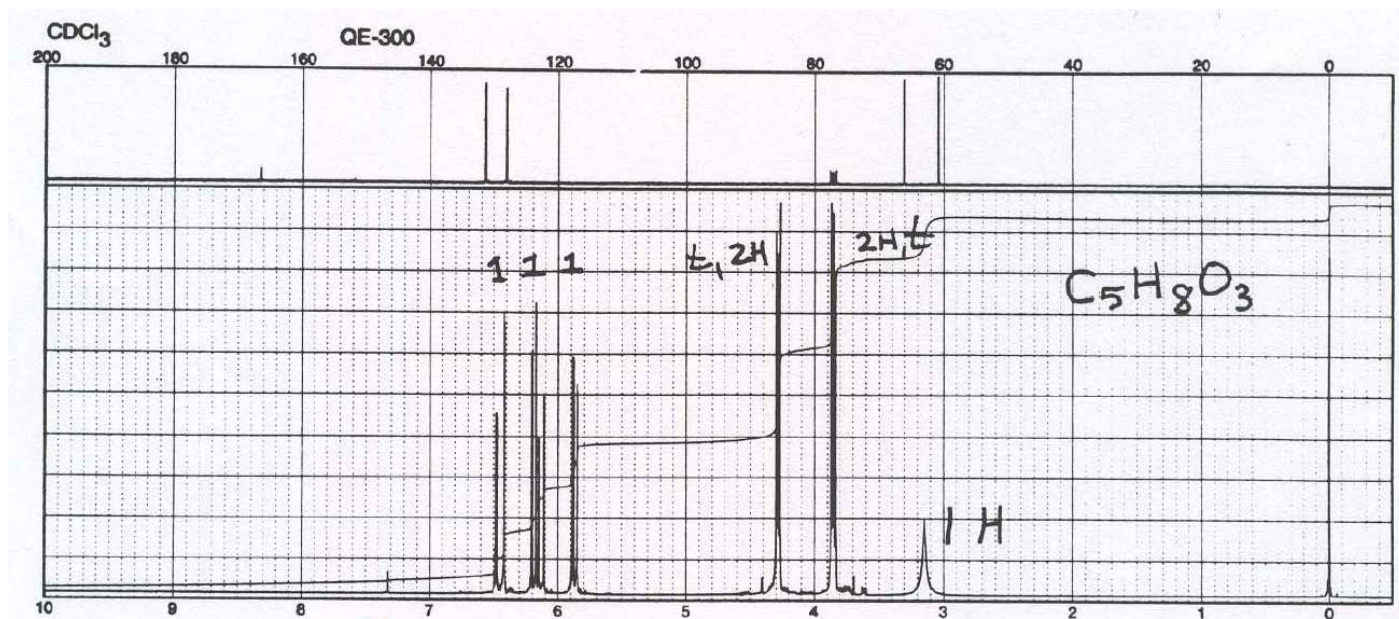
NAME: _____

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NAME: _____

Exam 1/610B/Pagenkopf

(10 points) NMR. Propose a structural formula based on the following NMR information. Show your work, and account for the observed patterns of splitting.



NAME: _____

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NAME: _____

(5 points) Nomenclature. Provide a structure for each of the following.

a. 1-bromocyclopentene

b. butylmagnesium chloride

c. 2-methyl-3-pentanone

d. 4-hydroxyhexanal

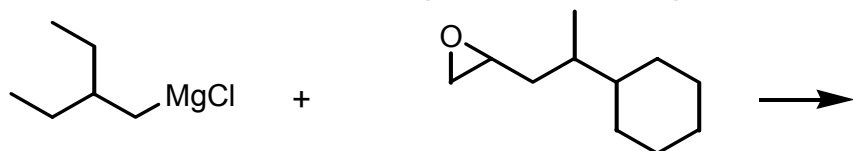
e. trans-2,3-dimethylcyclohexanecarbaldehyde

NAME: _____

Exam 1/610B/Pagenkopf

(4 points) There are two parts for each of the following questions. For the part **a**, show the expected products from the reaction. In your answer to part **a** assume a work-up and show the alcohol products, not the metal alkoxides. For part **b** of each question, show how the organometallic reagent used in part **a** can be made from any inorganic reagents you need and an organic molecule containing any combination of the following atoms: carbon, hydrogen, chlorine, bromine, iodine, oxygen or nitrogen.

- Show the product from the following reaction
- Show how to make the organometallic reagent

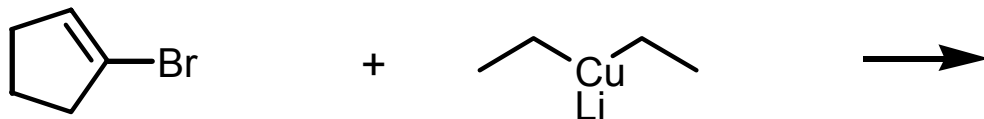


NAME: _____

Exam 1/610B/Pagenkopf

...continued (4 points).

- Show the product from the following reaction
- Show how to make the organometallic reagent

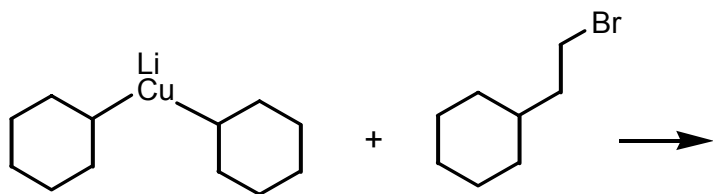


NAME: _____

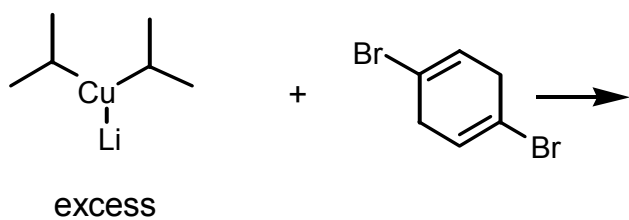
Exam 1/610B/Pagenkopf

(9 points) Show the expected products from the following reactions. You may assume the reaction is finished with a standard workup if needed.

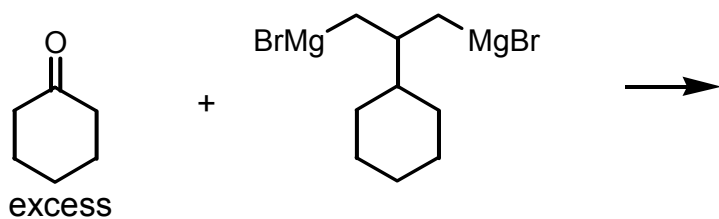
a.



b.



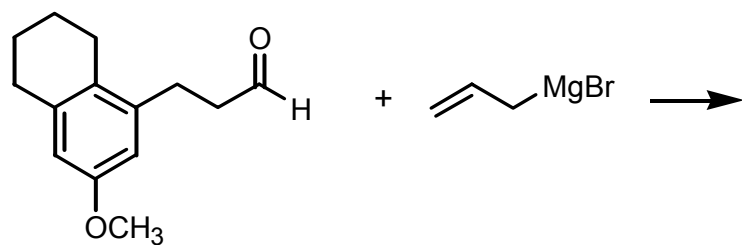
c.



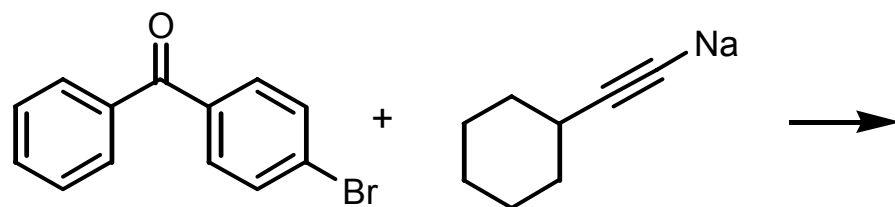
NAME: _____

Exam 1/610B/Pagenkopf

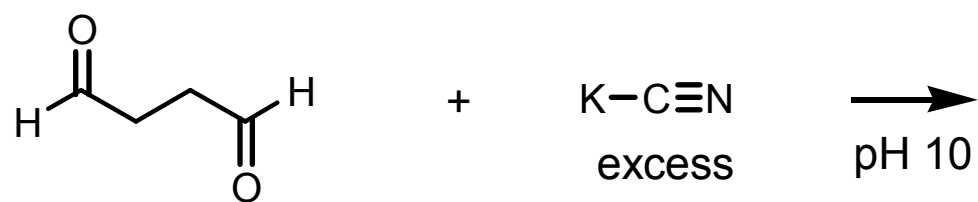
d.



e.



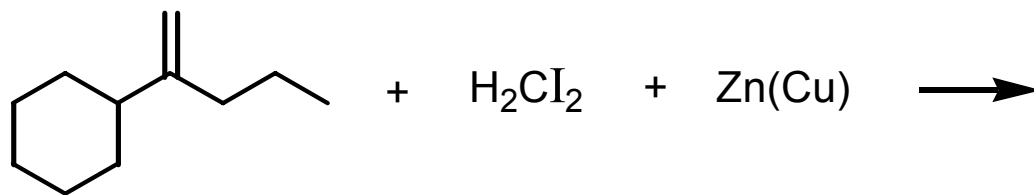
f.



NAME: _____

Exam 1/610B/Pagenkopf

g.



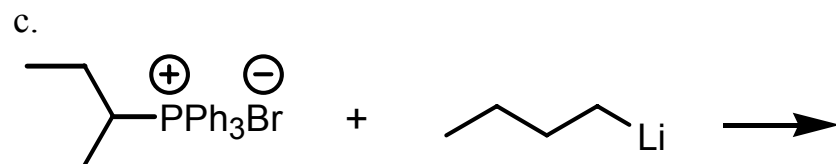
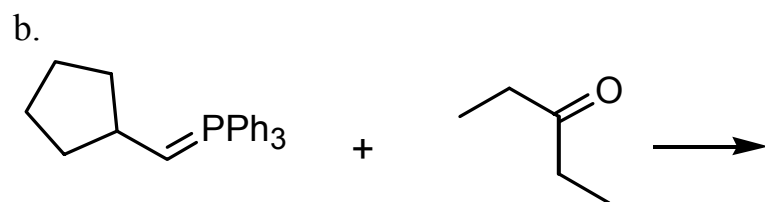
h.



NAME: _____

Exam 1/610B/Pagenkopf

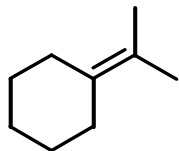
(9 points) Show the expected products from the following reactions.



NAME: _____

Exam 1/610B/Pagenkopf

(3 points) Propose a synthesis of the following structure starting with a molecule of 6 carbons or less and any organic, organometallic or inorganic reagents. You may use triphenylphosphine (which contains more than 6 carbons) as a reagent in your synthesis.



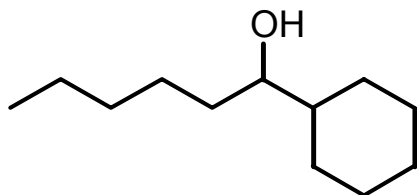
NAME: _____

Exam 1/610B/Pagenkopf

(8 points) Each of the following alcohols can be prepared by both of the following reactions:

- a) epoxide + organometallic reagent \rightarrow alcohol
- b) aldehyde or ketone + an organometallic reagent \rightarrow alcohol

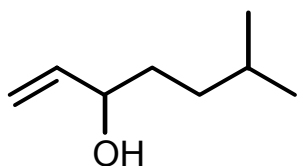
Propose two syntheses for following molecule starting from a) an epoxide and b) a carbonyl compound (aldehyde, ketone, etc.).



NAME: _____

Exam 1/610B/Pagenkopf

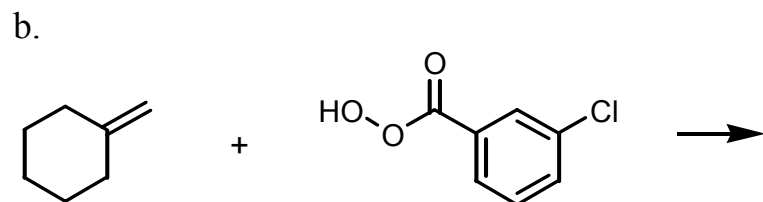
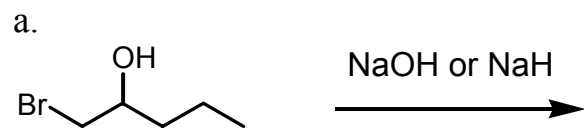
... continued (8 points) Propose two syntheses for following molecule starting from a) an epoxide and b) a carbonyl compound (aldehyde, ketone, etc.) and an organometallic reagent.



NAME: _____

Exam 1/610B/Pagenkopf

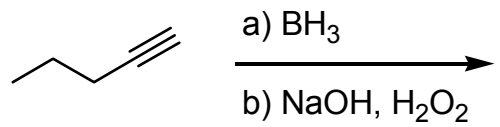
(4 points) Show the expected products from the following reactions. You may assume the reaction is finished with a standard workup if needed.



NAME: _____

Exam 1/610B/Pagenkopf

c.



d)

