

1st Letter of Last
Name

NAME:

610B Final Exam Cover Page

No notes or calculators of any sort allowed.

You have 3 hours to complete the exam.

CHEM 610B, 50995

Final Exam

Fall 2003

Instructor: Dr. Brian Pagenkopf

Email: _____

NAME: _____

Page	Points
3	4
4	5
5	9
6	9
7	9
8	9
9	10
10	10
11	10
12	10
13	10
14	6
15	8
16	10
17	9
18	8
	136

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																VIII A					
1A																2					
Periods																He					
1																	2				
H																	He				
1.00079																	4.00260				
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
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				
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				
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				
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)				
87	88	89	104	105	106																
Fr	Ra	Ac	Unq	Unp	Unh																
(223)	226.0254	227.0278	(261)	(262)	(263)																

*Lanthanide series

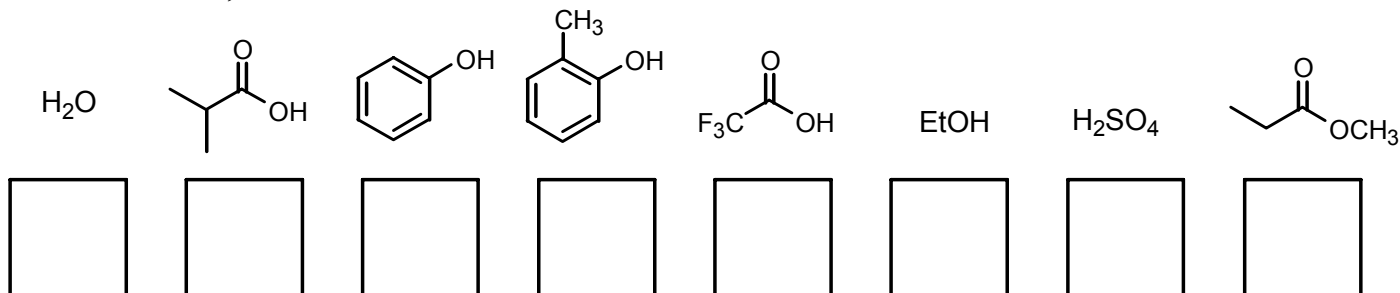
58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.12	140.9077	144.24	(145)	150.4	151.96	157.25	158.9254	162.50	164.9304	167.26	168.9342	173.04	174.967

† 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 is the most important question in organic chemistry?

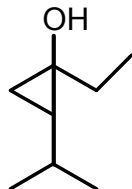
Question 2. a. (2 points). Rank the following molecules in order of increasing acidity (which is the same as decreasing pKa). Write a 8 in the box for the least acidic, a 1 in the box under the most acidic, and so on.



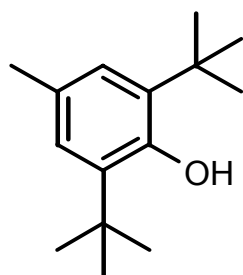
NAME: _____

(5 points) Nomenclature. Name the following.

a.



b.



Draw the following.

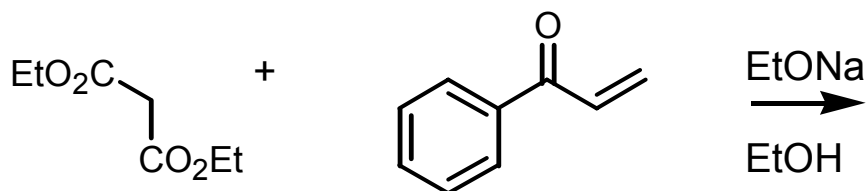
c. ethynylbenzene

d. benzylalcohol

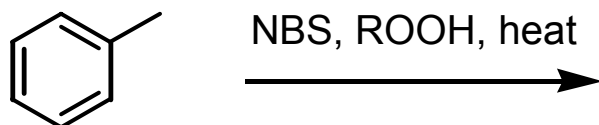
e. 3-hydroxybutanal

Question 3. (18 points) Show the expected products from the following reactions. You may assume the reaction is finished with a standard workup if needed. Show any product(s) that contains a carbon atom.

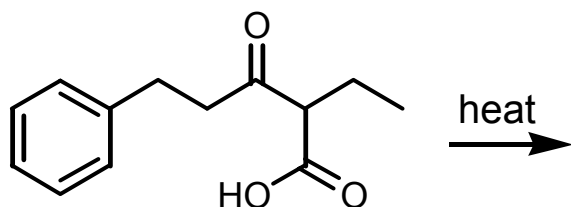
a.



b.

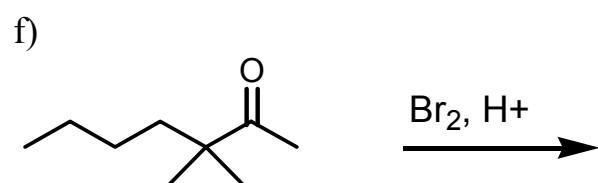
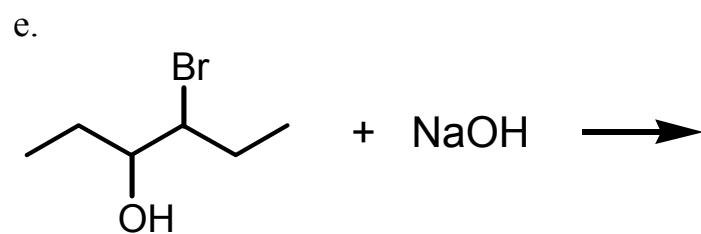
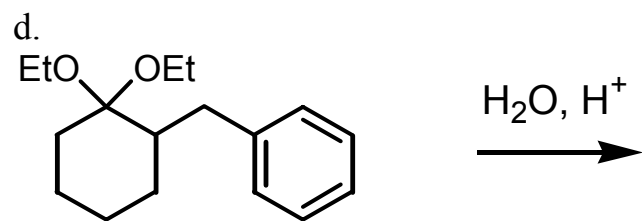


c.



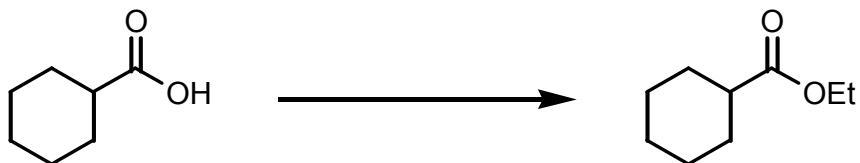
NAME: _____

Final Exam/610B/Pagenkopf

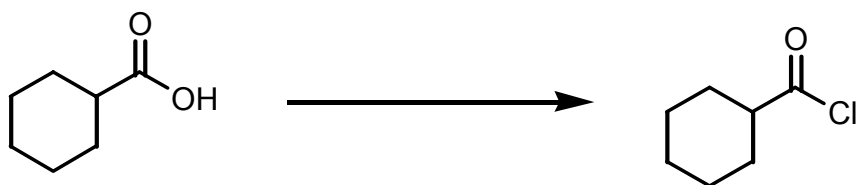


Question 4. (18 points) Provide the Reagents necessary to convert cyclohexanecarboxylic acid to the products shown. Some reactions might require more than one step.

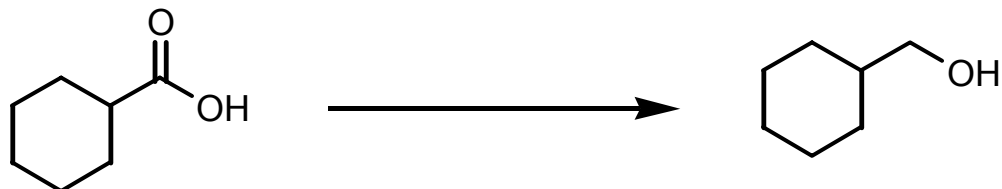
a.



b.



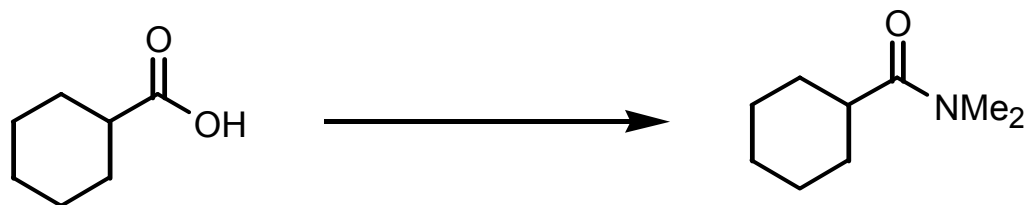
c.



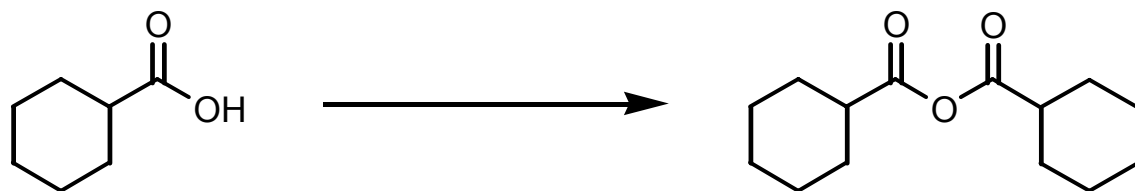
NAME: _____

Final Exam/610B/Pagenkopf

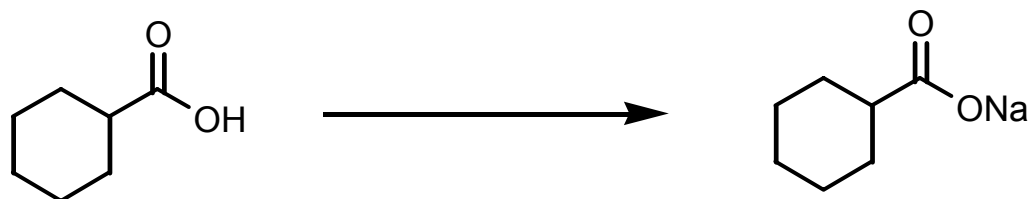
d.



e.

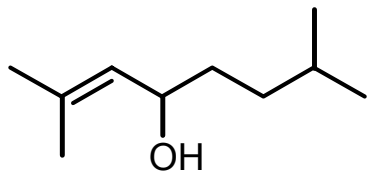


f.



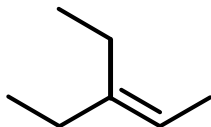
NAME: _____

Question 5. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



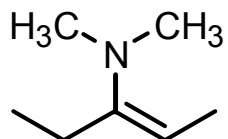
NAME: _____

Question 6. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



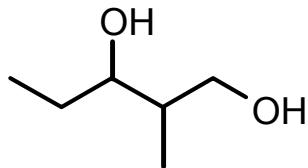
NAME: _____

Question 7. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



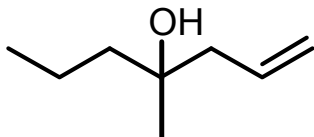
NAME: _____

Question 8. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



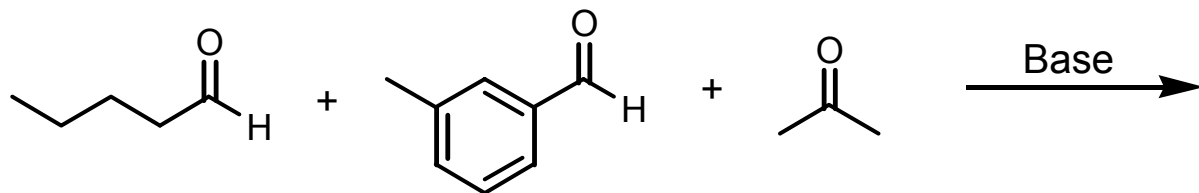
NAME: _____

Question 9. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



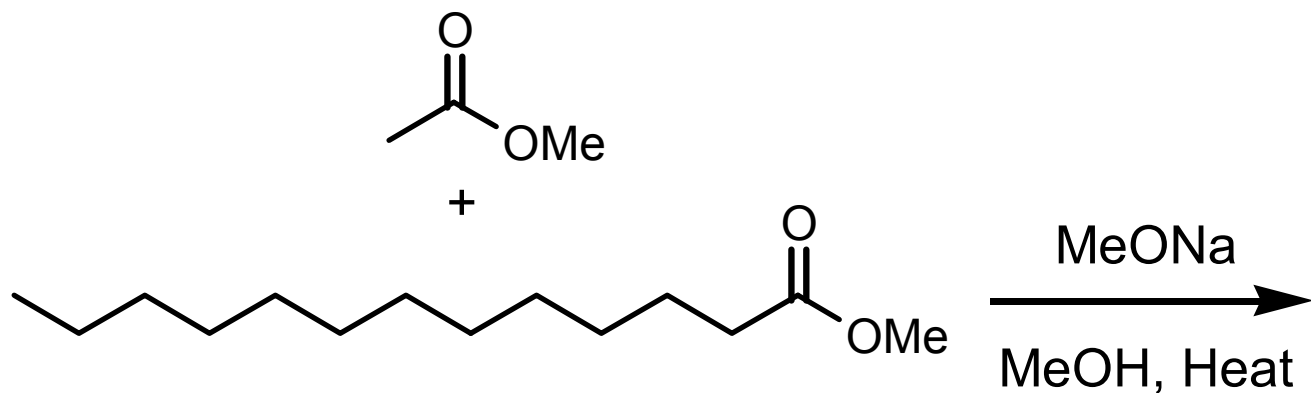
NAME: _____

Question 10. (6 points). Draw all the beta-hydroxy aldehyde or ketone products from aldol reaction among the following compounds. Only show aldol products between two molecules.



NAME: _____

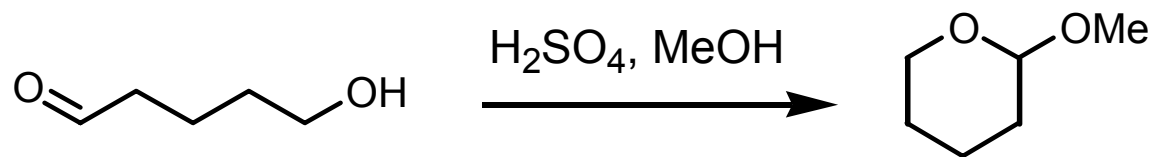
Question 11. (8 points) Draw structural formulas of all four Claisen condensation products.



NAME: _____

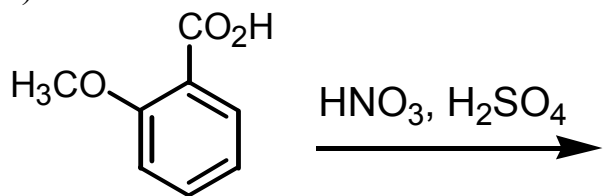
Final Exam/610B/Pagenkopf

Question 12. (10 Points) Propose a detailed reaction mechanism for the following reaction.

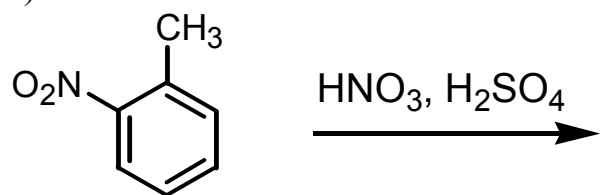


Question 13. (9 points). Draw the major product expected from each of the following reactions. For each nitration reaction, add only one nitro group to the aromatic ring.

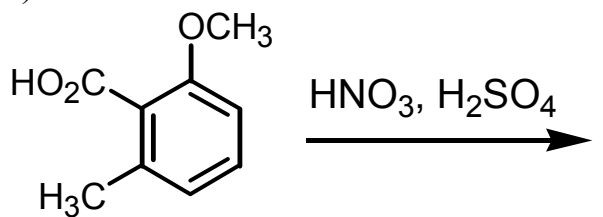
a)



b)



c)



NAME: _____

Miscellaneous Questions.

Question 14. (1 point) What does NMR stand for?

Question 15. (1 point) NMR uses radiation from what part of the electromagnetic spectrum?

Question 16. (1 point) In a modern NMR the magnetic field stays constant. What is changing or going on when a signal is said to resonate “up field”?

Question 17. (1 point) If someone asks you whether he or she should be afraid of MRI (magnetic resonance imaging, like NMR) because of radioactivity concerns, you can explain:

Question 18. (3 points) What are Hückels criteria for aromaticity?

Question 19. (1 point) What’s the one thing you would most like to see changed in organic chemistry class to make it more interesting?