Organic Chemistry I

Chem 230

Exam 4

November 22nd, 2019

Dr. R.W. Nagorski

We often discover what will do, by finding out what will not do; and probably those who never made a mistake, never made a discovery.
Samuel Smiles (1812–1904)

1)	_____/6	9)	_____/4
2)	_____/4	10)	_____/3
3)	_____/10	11)	_____/8
4)	_____/4	12)	_____/6
5)	_____/2	13)	_____/4
6)	_____/6	14)	_____/36
7)	_____/4		
8)	_____/3		

Bonus _____***/6***

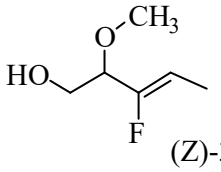
Total _____***/100***

Name:_____

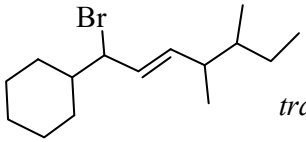
ID#:_____

Nomenclature:

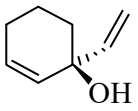
1) Give the correct IUPAC names for the following compounds. (*6 points*)

a) 

(Z)-3-fluoro-2-methoxy-3-penten-1-ol

b) 

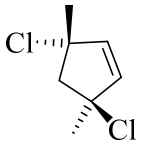
trans-1-bromo-1-cyclohexyl-4,5-dimethyl-2-heptene

c) 

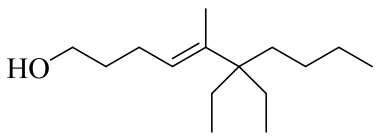
(S)-1-ethenyl-2-cyclohexen-1-ol

2) Draw the structures that are represented by the following IUPAC names. (*4 points*)

a) (3S,5S)-3,5-dichloro-3,5-dimethylcyclopentene



b) (4Z)-5-bromo-6,6-diethyl-4-decenol



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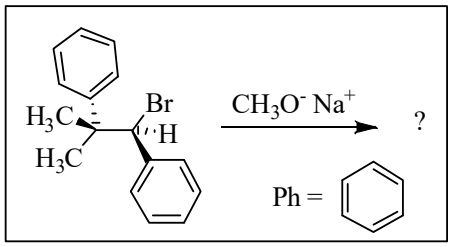
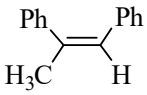
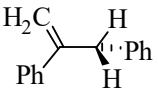
Multiple Choice:

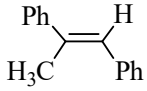
3) Circle the correct response to the question. (*2 points each = 10 points*)

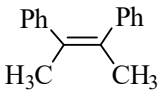
a) What would be the organic product of the following reaction?



a) 

b) 

c) 

d) 

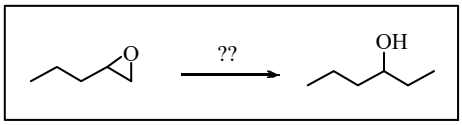
e) None of the choices

b) Which of the following conditions would produce the alcohol shown in the reaction?

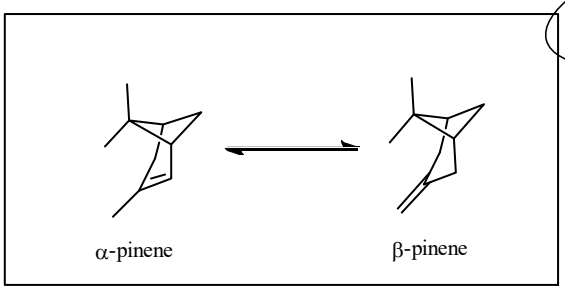
a) H_2O, H^+ b) NaOH c) PCC

d) 1) CH_3MgBr
2) H^+, H_2O

e) 1) $LiAlH_4$
2) H_2O, H^+



c) Under special reaction conditions, α-pinene and β-pinene can be in equilibrium (caused to interconvert reversibly). Which of the pinene compounds would predominate at equilibrium?



a) The ? -isomer will predominate.

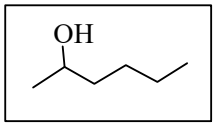
b) The β-isomer will predominate.

c) The isomers will be equally favored.

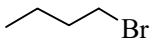
d) A third isomer would predominate.

e) None of the above is true.

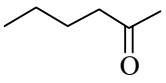
d) Which of the following reactions would produce the alcohol shown?



a) CH_3I → 1) Mg/Et_2O 2) $CH_3CH_2CH_2CH_2CHO$ 2) H^+/H_2O

b) 

→ 1) Mg/Et_2O 2) CH_3CHO 2) H^+/H_2O

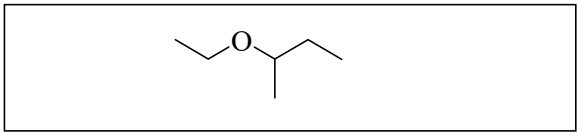
c) 

→ $NaBH_4$, CH_3OH

d) All of the choices.

e) None of the choices.

e) What would be the best name of the following compound?

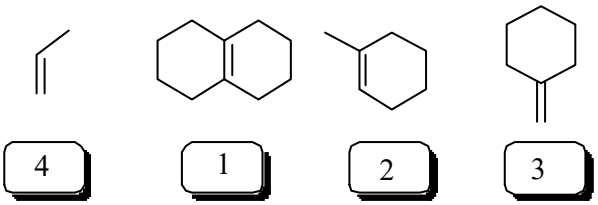


a) 3-methyl-4-oxohexane b) (1-ethyl)-diethylether c) 2-butoxyethane

d) 1-methyl-1-ethoxypropane e) 2-ethoxybutane

Conceptual Problems:

4) Rank the following alkenes from most stable to least stable. (*4 points*)



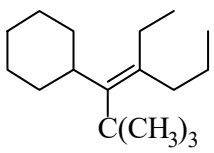
4 | 1 | 2 | 3

5) Why are Grignard Reagents generated in solvents like EtOEt rather than a solvent like ethanol? (*2 points*)

Diethyl ether stabilizes the Grignard reagent by complexing to the magnesium whereas ethanol would undergo an Bronsted acid/base reaction which would destroy the Grignard reagent.

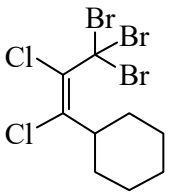
6) For the structures shown below, state whether double bonds are E, Z, *cis*, *trans, or none of the above*. (*6 points*)

a)



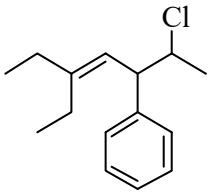
Z

b)



Z

c)



none

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7) For the compounds shown below, calculate the degree of unsaturation. (*4 points*)

a) $C_{21}H_{32}ClNO$

$H_{sat} = 2(21) + 2 - 1 + 1 = 44$

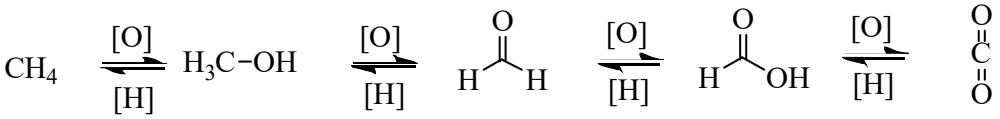
$(44 - 32)/2 = 6$ dbe's

b) $C_{10}H_{13}FS$

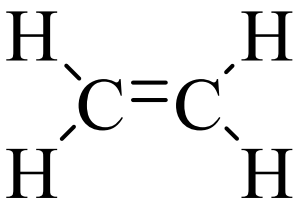
$H_{sat} = 2(10) + 2 - 1 = 21$

$(21 - 13)/2 = 4$ dbe's

8) Show the oxidative stages for the oxidation of methane. (*3 points*)



9) For the compound shown below, indicate the hybridization of the carbons and the approximate bond angles between the atoms? (*4 points*)

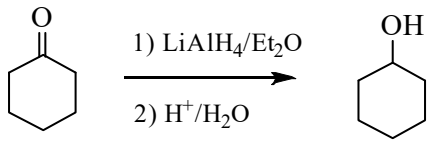


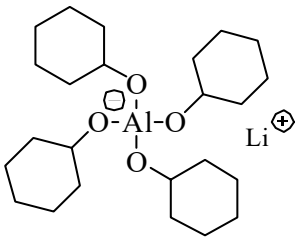
sp^2-hybridized

bond angle 120°

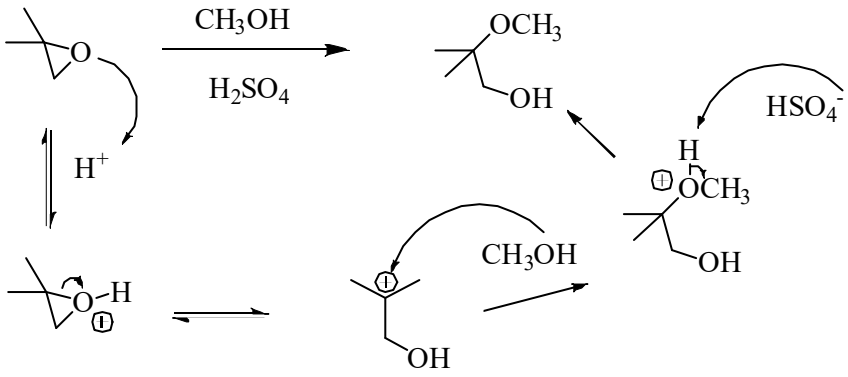
Mechanisms:

10) During the course of $LiAlH_4$ reduction of a ketone to an alcohol, an aluminum complex is formed prior to hydrolysis by water. Draw the aluminum complex intermediate for the reaction below? (*3 points*)





11) Show the mechanism for the following reaction. (*8 points*)



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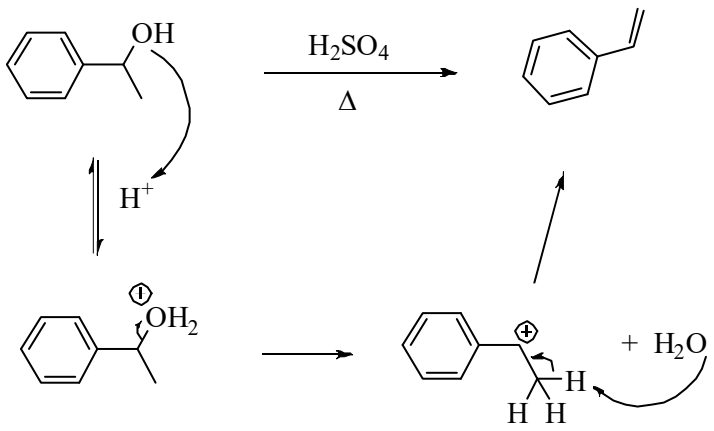
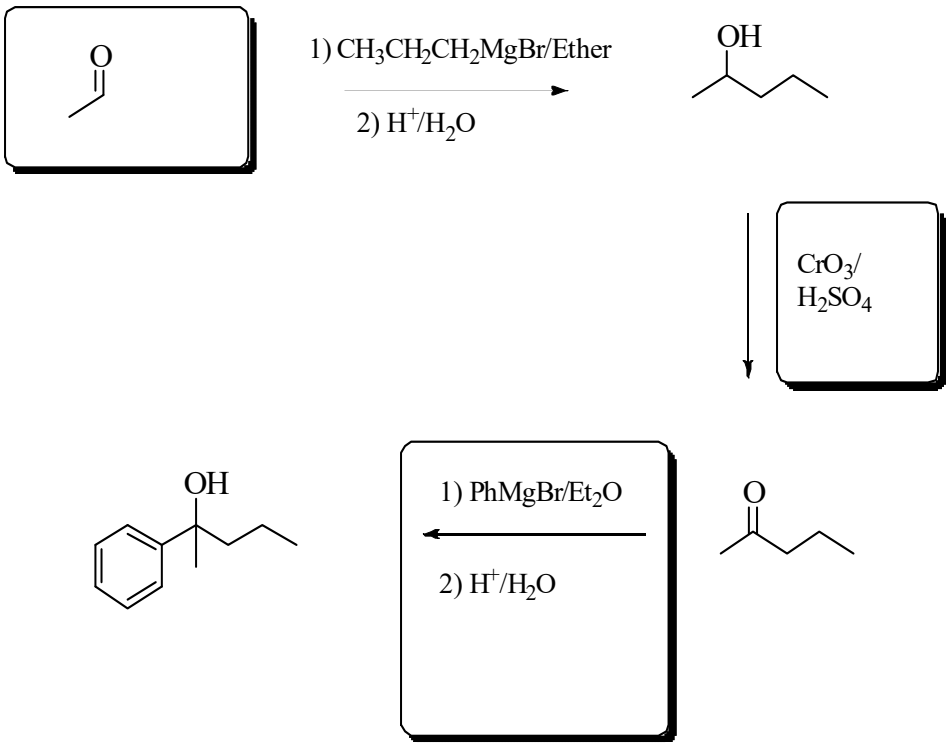
12) Provide a mechanism for the following transformation. (*6 points*)

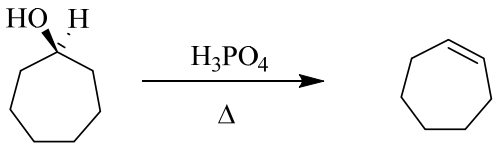


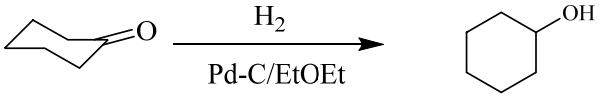
Reactions:

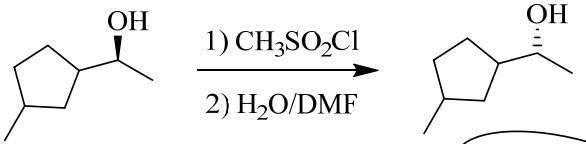
13) Fill in the missing reagents or products for the following reaction scheme. (*4 points*)



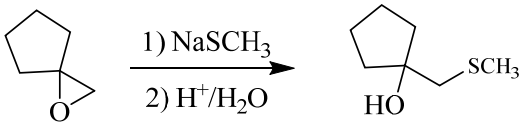
14) Give the products for the reactions shown below. (*36 points*)

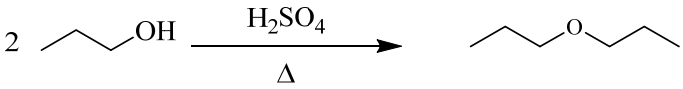
a) 

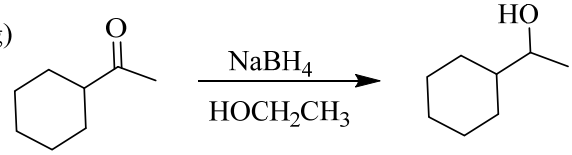
b) 

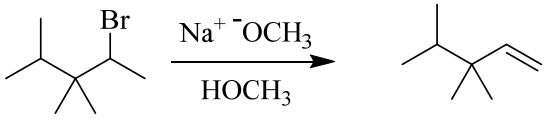
c) 

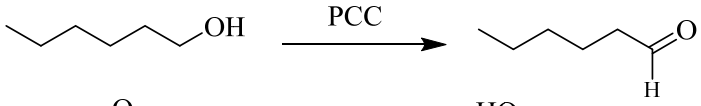
d) 

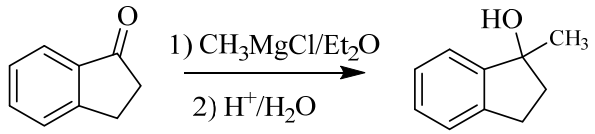
e) 

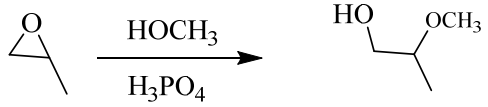
f) 

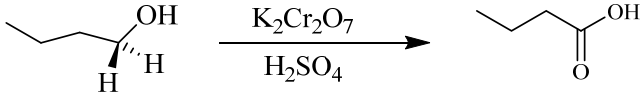
g) 

h) 

i) 

j) 

k) 

l) 

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Bonus Questions:

What is the hybridization of a carbon that is a part of an alkyne bond? (*3 points*)

sp-hybridized

Name two of the three rules for adding electrons to atomic orbitals? (*3 points*)

Hund's Rule
Pauli Exclusion Principle
Aufbau principle

YOUR ELEMENT.

1																	2
H																	He
Hydrogen																	Helium
1.0079																	4.0026
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
Lithium	Beryllium											Boron	Carbon	Nitrogen	Oxygen	Flourine	Neon
6.941	9.012											10.811	12.011	14.007	15.999	18.998	20.178
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
Sodium	Magnesium											Aluminum	Silicon	Phosphorus	Sulfur	Chlorine	Argon
22.990	24.305	3	4	5	6	7	8	9	10	11	12	26.982	28.086	30.974	32.064	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
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton
39.098	40.078	44.956	47.88	50.942	51.996	54.938	55.847	58.933	58.693	63.546	65.39	69.723	72.61	74.922	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
Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon
85.468	87.62	88.906	91.224	92.906	95.94	98.907	101.07	102.91	106.91	107.87	112.41	114.82	118.71	121.76	127.60	126.90	131.29
55	56	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Cesium	Barium	Lutetium	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon
132.91	137.33	174.97	178.49	108.95	183.85	186.21	190.2	192.22	195.08	196.97	200.59	204.38	207.2	208.98	(209)	(210)	(222)
87	88	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
Francium	Radium	Lawrencium	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium	Nihonium	Flerovium	Moscovium	Livermorium	Tennessine	Oganesson
(223)	(226)	(262)	(261.1)	(262.1)	(266.1)	(264.1)	(269.1)	(268.1)	(281.2)	(272.2)	(277)	(286)	(289)	(288)	(293)	(294)	(294)

57	58	59	60	61	62	63	64	65	66	67	68	69	70
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium
138.91	140.12	140.91	144.24	(145)	150.36	151.97	157.25	158.92	162.50	164.93	167.26	168.93	173.04
89	90	91	92	93	94	95	96	97	98	99	100	101	102
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No
Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium
(227)	232.04	(231)	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)

79 — Atomic Number
Au — Element Symbol
Gold — Element Name
196.97 — Standard Atomic Weight

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