CH 335

First Midterm Exam

Monday, January 24, 2022

Form A

Name\_\_\_\_\_

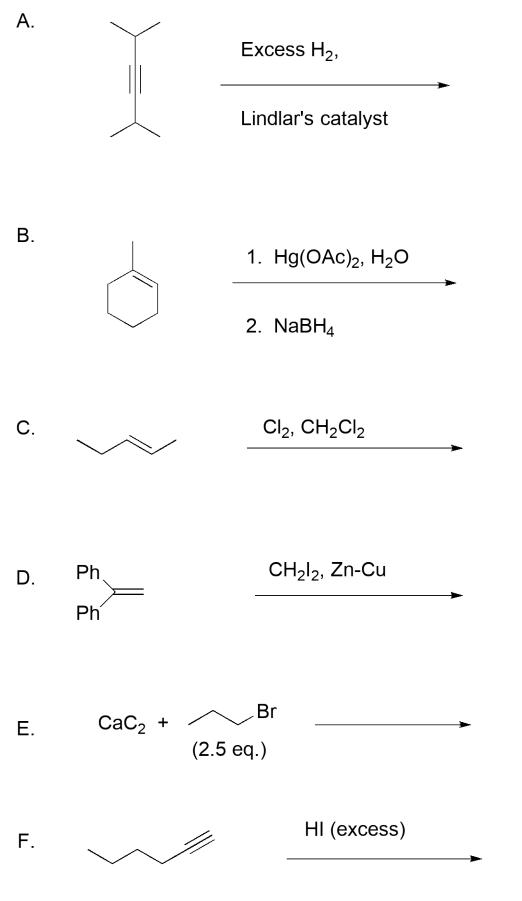
You may use model kits but no other material with chemical information without instructor approval.

Please do not use any electronic gadgets.

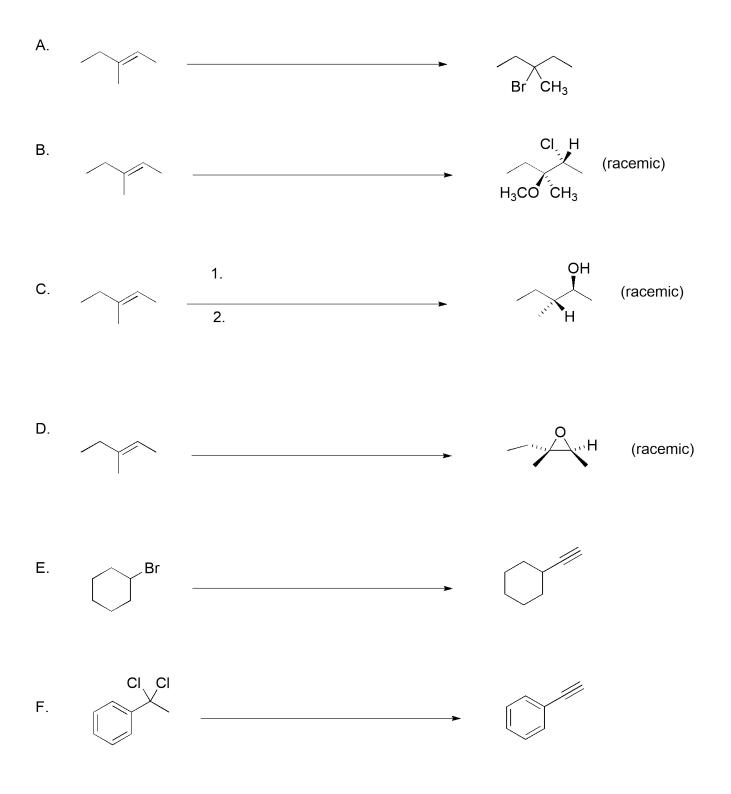
Ĥ																		
1.0079 lithium	beryllium	Ì										Î	boron	carbon	nitrogen	oxygen	fluorine	4.002 neor
3	4												5	6	7	8	9	10
Li I	Be												В	C	Ν	0	F	N
6.941	9.0122												10.811	12.011	14.007	15.999	18.998	20.1
odium 11	magnesium 12												aluminium 13	silicon 14	phosphorus 15	sulfur 16	chlorine 17	argo 18
Na	Mg												AI	Si	P	S	CI	A
22.990	24.305												26.982	28.086	30.974	32.065	35.453	39.9
tassium 19	calcium 20		scandium 21	titanium 22	vanadium 23	chromium 24	manganese 25	iron 26	cobalt 27	nickel 28	copper 29	zinc 30	gallium 31	germanium 32	arsenic 33	selenium 34	bromine 35	krypt 36
K	Ca		Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	K
9.098	40.078		44.956	47.867	50.942	51.996	54.938	55.845	58.933	58.693	63,546	65.39	69.723	72.61	74.922	78.96	79.904	83.8
bidium 37	strontium 38		yttrium 39	zirconium 40	niobium 41	molybdenum 42	technetium 43	ruthenium 44	rhodium 45	palladium 46	silver 47	cadmium 48	indium 49	tin 50	antimony 51	tellurium 52	lodine 53	xeno 54
Rb	Ŝr		Ŷ	Žr	Nb	Мо	Tc	Ru	Rh	Pd	Ag	Cd	În	Sn	Sb	Te	Ĩ	X
35.468	87.62		88.906	91.224	92.906	95.94	[98]	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.76	127.60	126.90	131.
aesium 55	barium 56	57-70	lutetium 71	hafnium 72	tantalum 73	tungsten 74	rhenium 75	osmium 76	iridium 77	platinum 78	gold 79	mercury 80	thallium 81	lead 82	bismuth 83	polonium 84	astatine 85	rado 86
Cs	Ba	*	Lu	Hf	Та	W	Re	Os	Ir	Pt	Au	Hg	ΤI	Pb	Bi	Po	At	R
32.91	137.33		174.97 lawrencium	178.49	180.95 dubnium	183.84	186.21 bohrium	190.23 hassium	192.22 meitnerium	195.08 ununnilium	196.97	200.59	204.38	207.2	208.98	[209]	[210]	[222
ancium 87	radium 88	89-102	103	rutherfordium 104	105	seaborgium 106	107	108	109	110	unununium 111	ununbium 112		ununquadium 114				
Fr	Ra	* *	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	3 C C C C C C C C C C C C C C C C C C C		Uuq				
[223]	[226]		[262]	[261]	[262]	[266]	[264]	[269]	[268]	[271]	[272]	[277]		[289]				

*Lanthanide series	lanthanum 57	cerium 58	praseodymium 59	neodymium 60	promethium 61	samarium 62	europium 63	gadolinium 64	terbium 65	dysprosium 66	holmium 67	erbium 68	thulium 69	ytterbium 70
Lanthaniue Series	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
	138.91	140.12	140.91	144.24	[145]	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04
	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium		mendelevium	nobelium
* * Actinide series	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
	[227]	232.04	231.04	238.03	[237]	[244]	[243]	[247]	[247]	[251]	[252]	[257]	[258]	[259]

1. (30 points) Write the expected products for each of the following reactions. Specify stereochemistry where appropriate (you may write "racemic" in place of drawing a second enantiomer).

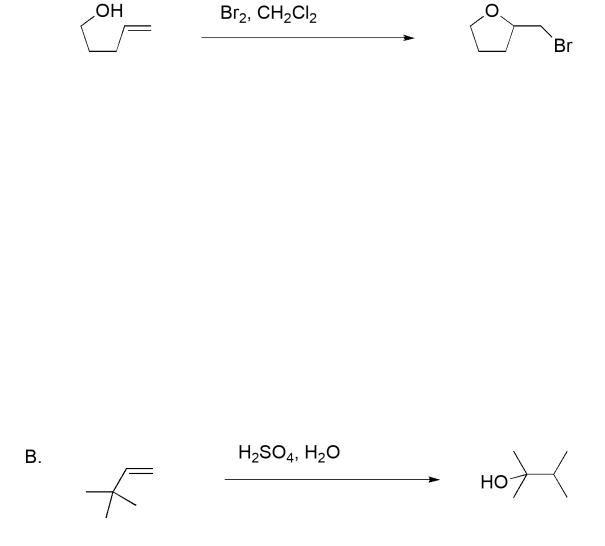


2. (25 points) Write (over the arrow) the reagents needed to accomplish the following transformations.

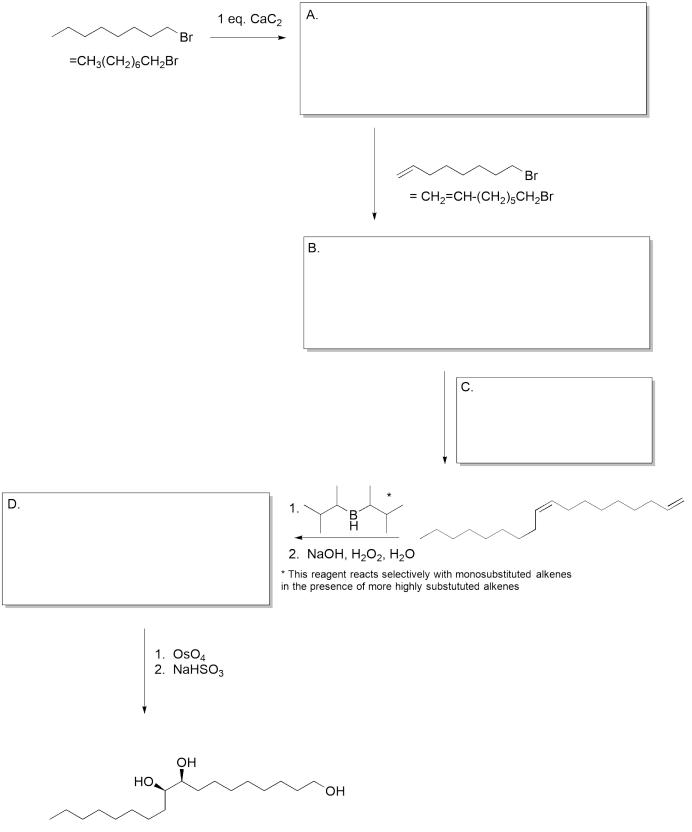


3. (20 points) Write mechanisms (using the correct electron-pushing formalism, and as many steps as needed) for each of the following transformations.

Α.



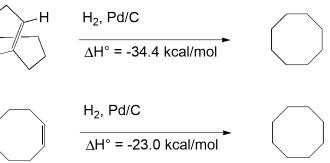
4. (16 points) Long-chain fatty alcohols are often observed to be chemical signaling agents in insect biochemistry. Fill in the boxes for intermediate structures or reagents in the following synthesis of (9S, 10R)-1,9,10-octadecanetriol. (You may abbreviate using the  $(CH_2)_n$  terminology).



5. (9 points) The heat of hydrogenation for *trans*-cyclooctene, shown at the right) is -34.4 kcal/mol.

Н

Explain why this is different from that for *cis*-cyclooctene (-23.0 kcal/mol).



Bond strengths (kcal/mol):

$\begin{array}{cccc} {\rm Cl-Cl} & 58 \\ {\rm Br-Br} & 46 \\ {\rm I-I} & 36 \\ {\rm H-F} & 136 \\ {\rm H-Cl} & 103 \\ {\rm H-Br} & 87 \\ {\rm H-I} & 71 \\ {\rm CH}_3 {\rm -H} & 105 \\ {\rm CH}_3 {\rm CH} & 105 \\ {\rm CH}_3 {\rm CH-H} & 98.5 \\ {\rm (CH}_3)_3 {\rm C-H} & 96.5 \\ {\rm CH}_3 {\rm -F} & 110 \\ {\rm CH}_3 {\rm -Cl} & 85 \\ {\rm CH}_3 {\rm -Br} & 70 \\ \end{array}$
$\begin{array}{cccccccc} I-I & & 36 \\ H-F & & 136 \\ H-Cl & & 103 \\ H-Br & & 87 \\ H-I & & 71 \\ CH_3-H & & 105 \\ CH_3CH_2-H & & 101 \\ (CH_3)_2CH-H & & 98.5 \\ (CH_3)_3C-H & & 96.5 \\ CH_3-F & & 110 \\ CH_3-Cl & & 85 \\ \end{array}$
$\begin{array}{ccccc} H-F & 136 \\ H-Cl & 103 \\ H-Br & 87 \\ H-I & 71 \\ CH_3-H & 105 \\ CH_3CH_2-H & 101 \\ (CH_3)_2CH-H & 98.5 \\ (CH_3)_3C-H & 96.5 \\ CH_3-F & 110 \\ CH_3-Cl & 85 \end{array}$
$\begin{array}{cccc} H-Cl & 103 \\ H-Br & 87 \\ H-I & 71 \\ CH_3-H & 105 \\ CH_3CH_2-H & 101 \\ (CH_3)_2CH-H & 98.5 \\ (CH_3)_3C-H & 96.5 \\ CH_3-F & 110 \\ CH_3-Cl & 85 \end{array}$
$\begin{array}{cccc} H-Br & 87 \\ H-I & 71 \\ CH_3-H & 105 \\ CH_3CH_2-H & 101 \\ (CH_3)_2CH-H & 98.5 \\ (CH_3)_3C-H & 96.5 \\ CH_3-F & 110 \\ CH_3-Cl & 85 \\ \end{array}$
$\begin{array}{cccc} H \mbox{-} I & 71 \\ CH_3 \mbox{-} H & 105 \\ CH_3 CH_2 \mbox{-} H & 101 \\ (CH_3) \mbox{-} CH \mbox{-} H & 98.5 \\ (CH_3) \mbox{-} CH \mbox{-} 96.5 \\ CH_3 \mbox{-} F & 110 \\ CH_3 \mbox{-} Cl \mbox{-} 85 \end{array}$
$\begin{array}{ccc} CH_3-H & 105 \\ CH_3CH_2-H & 101 \\ (CH_3)_2CH-H & 98.5 \\ (CH_3)_3C-H & 96.5 \\ CH_3-F & 110 \\ CH_3-Cl & 85 \end{array}$
CH <sub>3</sub> CH <sub>2</sub> -H   101     (CH <sub>3</sub> ) <sub>2</sub> CH-H   98.5     (CH <sub>3</sub> ) <sub>3</sub> C-H   96.5     CH <sub>3</sub> -F   110     CH <sub>3</sub> -Cl   85
(CH <sub>3</sub> ) <sub>2</sub> CH-H     98.5       (CH <sub>3</sub> ) <sub>3</sub> C-H     96.5       CH <sub>3</sub> -F     110       CH <sub>3</sub> -Cl     85
(CH <sub>3</sub> ) <sub>3</sub> C-H 96.5   CH <sub>3</sub> -F 110   CH <sub>3</sub> -Cl 85
CH <sub>3</sub> -F 110 CH <sub>3</sub> -Cl 85
CH <sub>3</sub> -Cl 85
CH <sub>3</sub> -Br 70
CH <sub>3</sub> -I 57
CH <sub>3</sub> CH <sub>2</sub> -F 111
$CH_3CH_2-Cl$ 84
CH <sub>3</sub> CH <sub>2</sub> -Br 70
CH <sub>3</sub> CH <sub>2</sub> -I 56
(CH <sub>3</sub> ) <sub>2</sub> CH-F 111
(CH <sub>3</sub> ) <sub>2</sub> CH-Cl 84
(CH <sub>3</sub> ) <sub>2</sub> CH-Br 71
(CH <sub>3</sub> ) <sub>2</sub> CH-I 56
(CH <sub>3</sub> ) <sub>3</sub> C-F 110
(CH <sub>3</sub> ) <sub>3</sub> C-Cl 85
(CH <sub>3</sub> ) <sub>3</sub> C-Br 71
(CH <sub>3</sub> ) <sub>3</sub> C-I 55

