

1. Alkenes are considered nucleophilic. (a. 4 pts.) Are nucleophilic molecules electron rich or electron deficient?

1. _____

2. _____

- b. (6 pts.) List two facts about alkenes that would help explain why they are nucleophilic (rewriting or paraphrasing your response to part a. is not sufficient).

3. _____

4. _____

5. _____

6. _____

e⁻ rich
e⁻'s in π bonds are farther out away from the nuclei
in a db, 4 e⁻'s are between the 2 C atoms

2. (2 pts. ea.) The questions below refer to the reaction coordinate diagram draw to the right.

- a. Label the reactant(s) with an "a".
b. Label the product(s) with a "b".
c. Label the intermediate(s) with a "c".
d. Label the transition state(s) with a "d".
e. Does this reaction absorb or release energy?

7. _____

8. _____

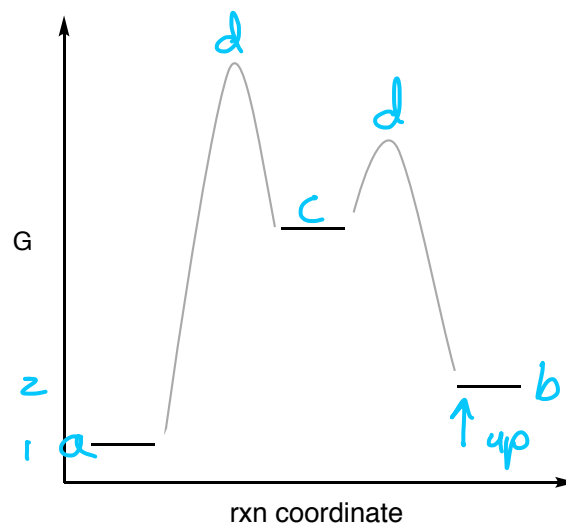
9. _____

10. _____

- f. Would this reaction have a positive or negative ΔG ?

absorb
 $G_f - G_i$ positive

11. _____



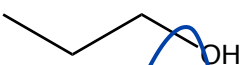
- g. Does the equilibrium favor the reactants or products.

reactants (they are lower in E)

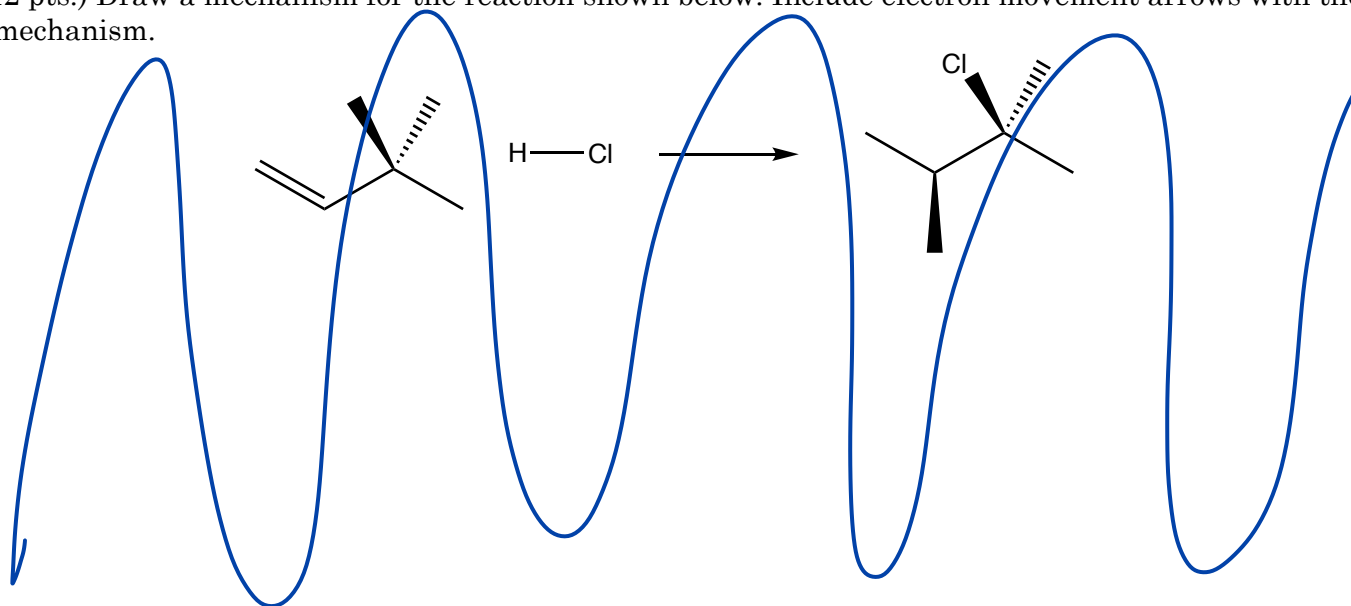
- h. How many steps would the mechanism of this reaction have?

2 steps

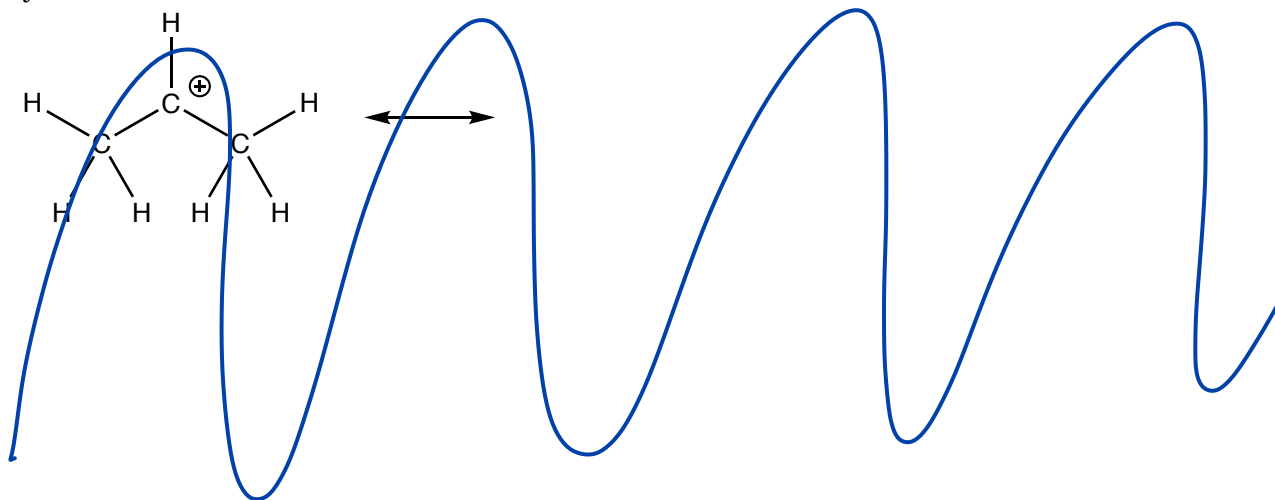
3. (16 pts.) Determine whether the following can react as nucleophiles, electrophiles, or neither.

	<chem>CH2CHCH2CH3</chem>	<chem>HOCH3</chem>	<chem>H+</chem>
<chem>Cl-</chem>	<chem>H2SO4</chem>	<chem>CH3CH2CH2CH(CH3)2</chem>	

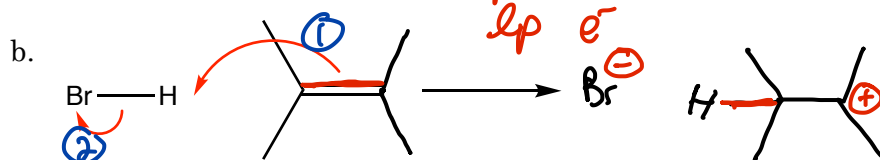
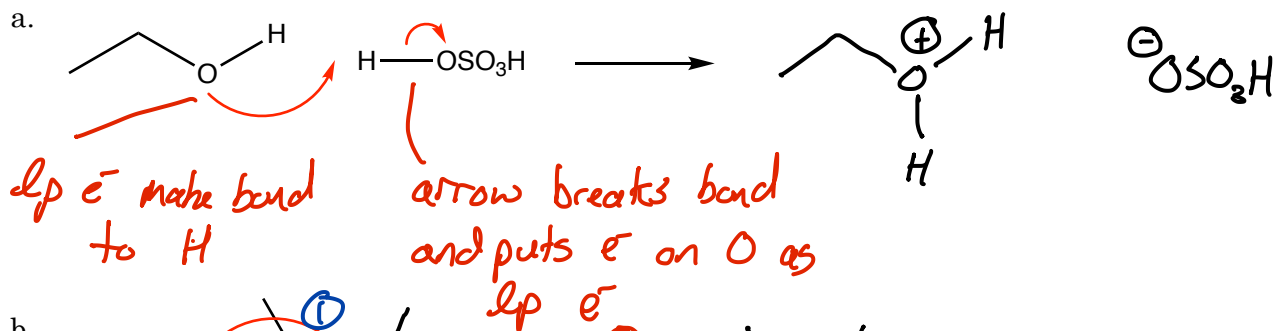
4. (12 pts.) Draw a mechanism for the reaction shown below. Include electron movement arrows with the mechanism.



5. a. (6 pts.) A secondary carbocation is drawn below. Draw a resonance contributor that shows how a neighboring σ bond stabilizes the carbocation through hyperconjugation. (b. 6 pts.) Briefly, explain why a 3° carbocation is more stable than a 2° carbocation.



6. (6 pts. each) Draw the structures that result based on the electron movement arrow that are shown.

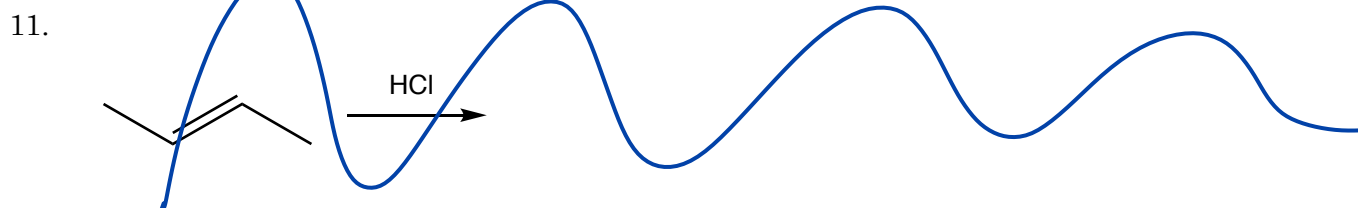
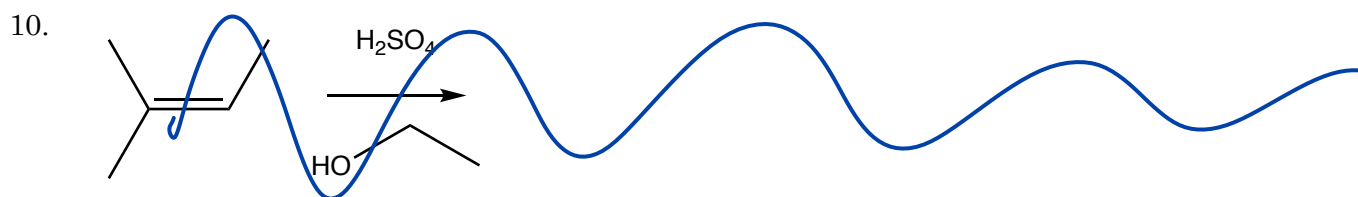
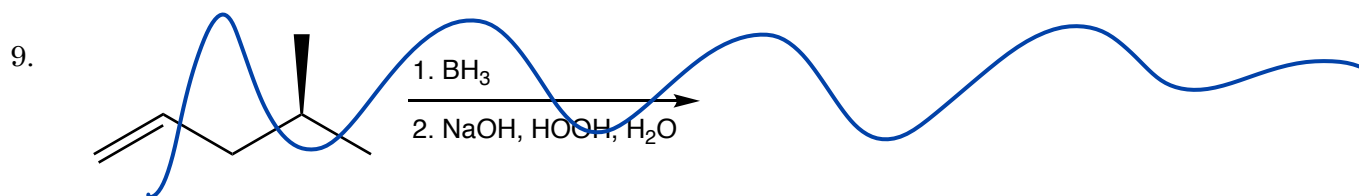
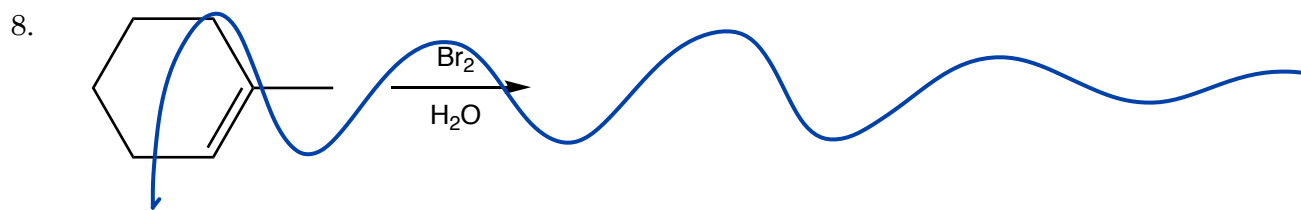


① e^- 's from 1 bond of db are moving and forming a bond with H

② e^- 's in H to Br bond are moving (break bond) and going to Br as lp e^-

7. a. (3 pts.) Products of a borane electrophilic addition reaction are formed via syn addition, anti addition, or both?
- b. (3 pts.) Products of a H^+ initiated electrophilic addition reaction are formed via syn addition, anti addition, or both?
- c. (3 pts.) Products of a Cl_2 or Br_2 initiated electrophilic addition reaction are formed via syn addition, anti addition, or both?

(8 pts. ea.) Predict the major organic product(s) for the following reactions. Remember to indicate the stereochemistry of the product(s) using wedge ($\blacktriangleright$), dashed ($\cdots$), or squiggly ($\sim$) bonds where appropriate, and to draw all stereoisomers that would be produced by the reaction. (If you don't know/remember what squiggly bonds are, just use the wedge and dashed bonds where appropriate).



1	H	1.0079	2	He	4.0026
3	Li	6.941	4	Be	9.012
11	Na	22.989	12	Mg	24.305
19	K	39	20	Ca	40
37	Cs	55	38	Sr	56
55	Rb	72	56	Ba	73
87	Fr	88	89	Ra	89
21	Sc	22	23	Ti	24
39	Y	40	41	Zr	42
57	La	58	59	Ce	60
72	Hf	73	74	Ta	75
89	Ac	90	91	Th	92
104	Rf	105	106	Sg	107
108	Bh	109	110	Mt	111
112	Hs	113	114	Db	115
116	Uu	117	118	Uub	119
120	Uuh	121	122	Uuq	123
124	Uus	125	126	Uut	127
132	Uus	133	134	Uub	135
136	Uuh	137	138	Uuq	139
140	Uus	141	142	Uut	143
144	Uuh	145	146	Uuq	147
148	Uus	149	150	Uub	151
152	Uuh	153	154	Uuq	155
156	Uus	157	158	Uut	159
160	Uuh	161	162	Uuq	163
164	Uus	165	166	Uub	167
168	Uuh	169	170	Uuq	171
172	Uus	173	174	Uut	175
176	Uuh	177	178	Uuq	179
180	Uus	181	182	Uub	183
184	Uuh	185	186	Uuq	187
188	Uus	189	190	Uut	191
192	Uuh	193	194	Uuq	195
196	Uus	197	198	Uub	199
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204	Uus	205	206	Uut	207
208	Uuh	209	210	Uuq	211
212	Uus	213	214	Uub	215
216	Uuh	217	218	Uuq	219
220	Uus	221	222	Uut	223
224	Uuh	225	226	Uuq	227
228	Uus	229	230	Uub	231
232	Uuh	233	234	Uuq	235
236	Uus	237	238	Uut	239
240	Uuh	241	242	Uuq	243
244	Uus	245	246	Uub	247
248	Uuh	249	250	Uuq	251
252	Uus	253	254	Uut	255
256	Uuh	257	258	Uuq	259
260	Uus	261	262	Uub	263
264	Uuh	265	266	Uuq	267
268	Uus	269	270	Uut	271
272	Uuh	273	274	Uuq	275
276	Uus	277	278	Uub	279
280	Uuh	281	282	Uuq	283
284	Uus	285	286	Uut	287
288	Uuh	289	290	Uuq	291
292	Uus	293	294	Uub	295
296	Uuh	297	298	Uuq	299
300	Uus	301	302	Uut	303
304	Uuh	305	306	Uuq	307
308	Uus	309	310	Uub	311
312	Uuh	313	314	Uuq	315
316	Uus	317	318	Uut	319
320	Uuh	321	322	Uuq	323
324	Uus	325	326	Uub	327
328	Uuh	329	330	Uuq	331
332	Uus	333	334	Uut	335
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348	Uus	349	350	Uut	351
352	Uuh	353	354	Uuq	355
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372	Uus	373	374	Uub	375
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448	Uuh	449	450	Uuq	451
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700	Uus	699	700	Uut	703
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728	Uuh	729	730	Uuq	731
732	Uus	733	734	Uut	735
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776	Uuh	777	778	Uuq	779
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