Name: Answer Key

Last First MI

Chemistry 233-002
Exam 3

Fall 2016

Dr. J. Osbourn

Instructions: This exam contains two parts: a multiple-choice section and a completion section. The first 11 multiple-choice questions should be answered on the provided Scantron. You should also circle your multiple-choice answers on the exam itself. The remaining 3 pages of the exam is a completion section. Answer these questions on the exam itself. Show all work and provide complete explanations. If you tend to doodle on your exam or have multiple possibilities drawn, circle the answer that you want graded.

The Periodic Table

1 IA																	18 VIIIA
1 H 1.01	2 IIA											13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.6	53 I 126.9	54 Xe 131.29
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac^ (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
^	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

****Please do not rip off this exam cover page****

Name: _____
Last First MI

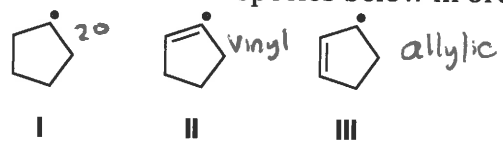
Grading Page: Exam 3

Page	Points Possible	Points Earned
Multiple Choice (3-5)	22	
6	29	
7	24	
8	25 +1 bonus	
TOTAL	**100**	

Multiple-Choice

Choose the one best answer for each of the following questions. Record each answer on the provided Scantron sheet. *(2 points each)*

1. Rank the radical species below in order of **increasing** stability.

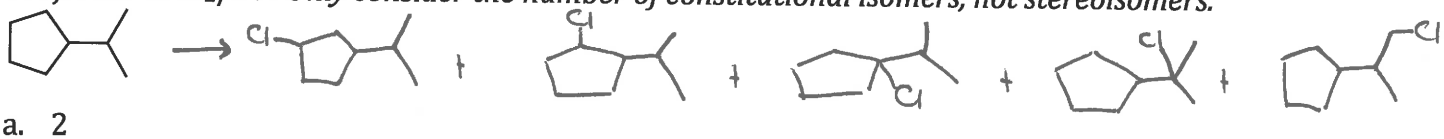


I II III

II < I < III

a. I < II < III
b. II < III < I
c. II < I < III
d. II < I = III
e. It is not possible to determine

2. How many different mono-chlorination products are possible when the compound below is subjected to Cl_2/hν? *Only consider the number of constitutional isomers, not stereoisomers.*



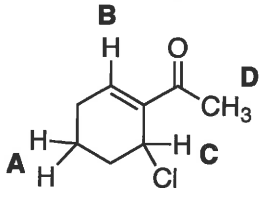
a. 2
b. 4
c. 5
d. 6
e. 8

3. The two indicated protons in the molecule below are:

diastereomers

a. Enantiotopic
b. Diastereotopic
c. Homotopic
d. Heterotopic

4. In the molecule shown below, proton A is the most shielded while proton B is the most deshielded. (downfield) (upfield)

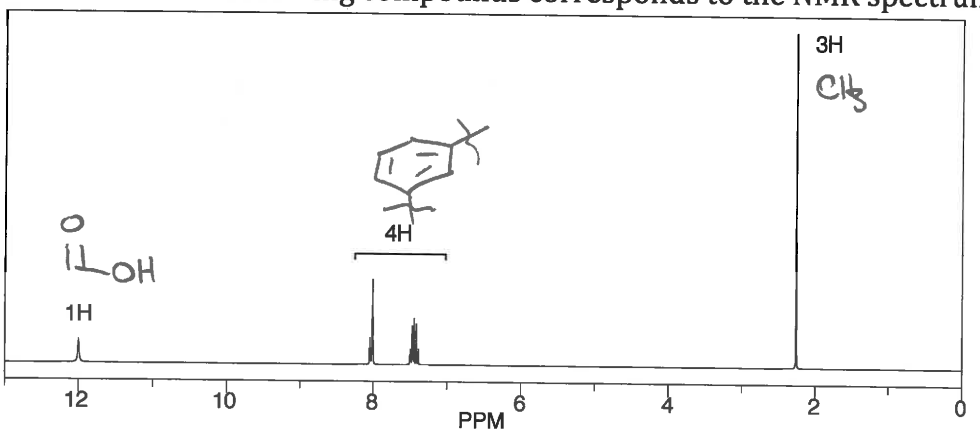


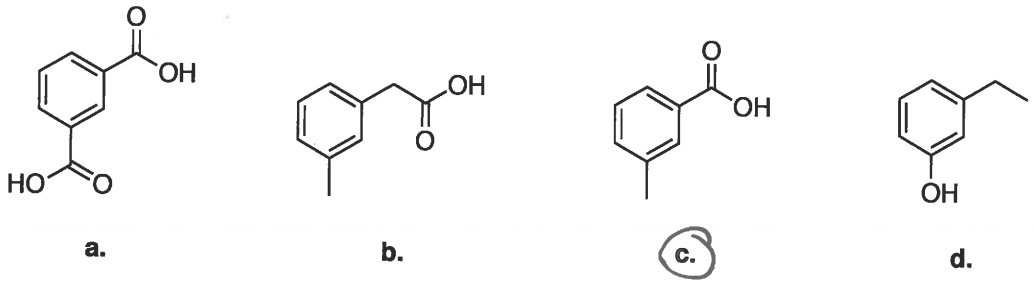
a. A, B
b. D, B
c. B, D
d. D, C
e. B, A

5. Which one of the following statements is **false**?

   a. A carbocation intermediate is not present in the hydroboration-oxidation of alkenes.
   b. In the hydroboration step, the H and B add syn across the double bond.
   c. Hydroboration-Oxidation follows anti-Markovnikov addition.
   d. Only 1/3 mole of BH_3 is required to react with 1 mole of alkene.
   e. None of the above statements are false.

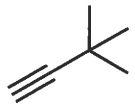
6. Which one of the following compounds corresponds to the NMR spectrum shown below?





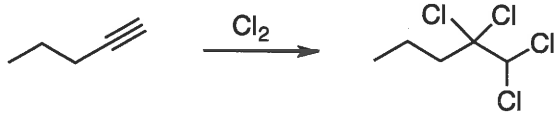
a. b. c. d.

7. What is the common name for the compound shown below?



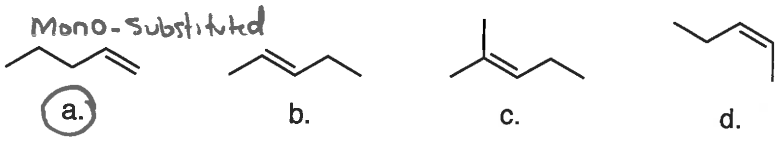
   a. *tert*-butylethylene
   b. neopentylethylene
   c. neopentlyacetylene
   d. *tert*-butylacetylene
   e. *tert*-butylethyne

8. How would you best classify the transformation shown below?



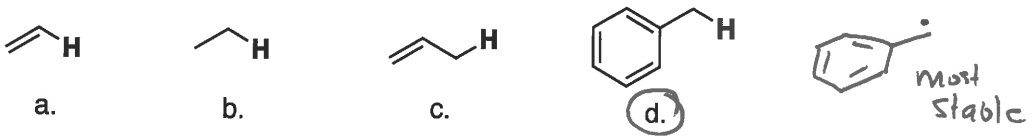
   a. Oxidation
   b. Reduction
   c. Neither

9. Which molecule below will undergo hydrogenation at the fastest rate?



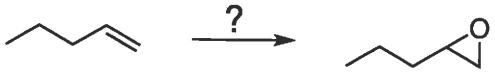
a. b. c. d.

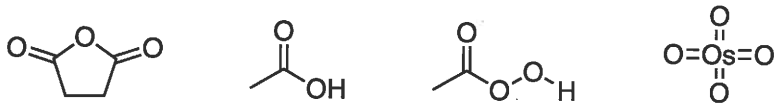
10. Which one of the indicated hydrogen is most readily abstracted in a free radical halogenation reaction?



a. b. c. d.

11. Which reagent shown below could be used to accomplish the following transformation?



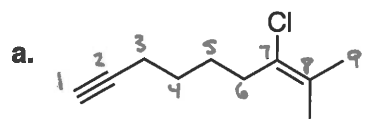


a. b. c. d.

a peroxyacid

Completion Section
Answer the remaining questions in the spaces provided.

12. Provide the IUPAC name for each compound shown below. *(2 points each)*



(4)

(+1) Correct substituents w/ correct #

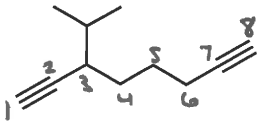
(+1)

7-chloro-8-methyl-7-nonen-1-yne

or

non-7-en-1-yne

If they write E/Z just cross it out... don't take off points



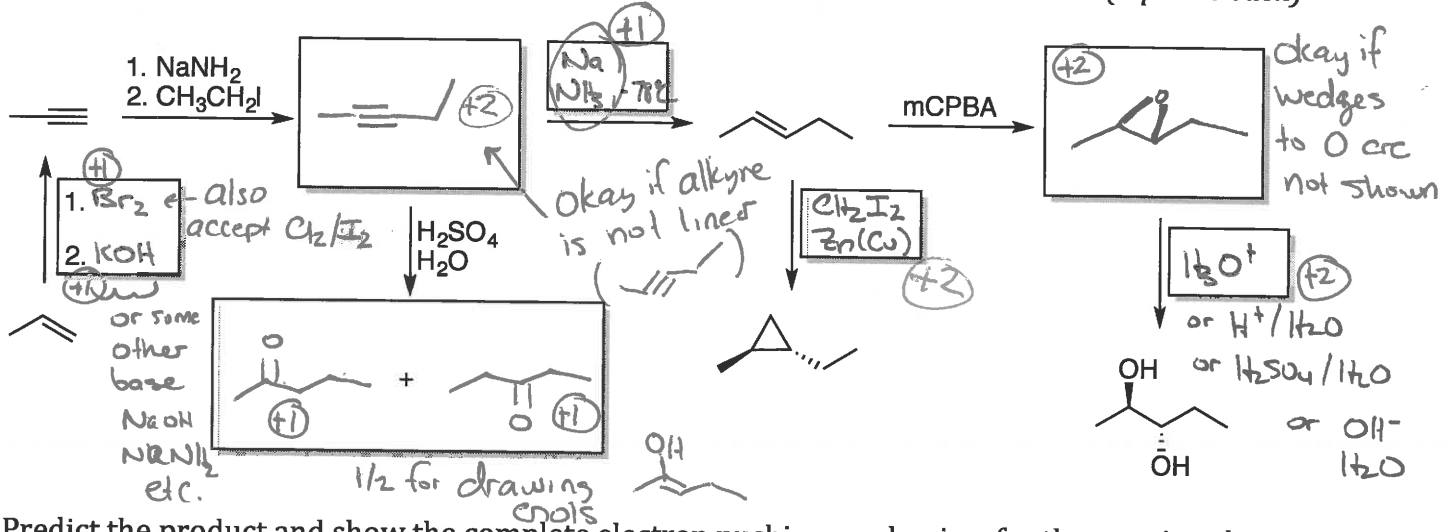
must have "a"

3-isopropyl-1,7-octadiyne

(+1) (+1)

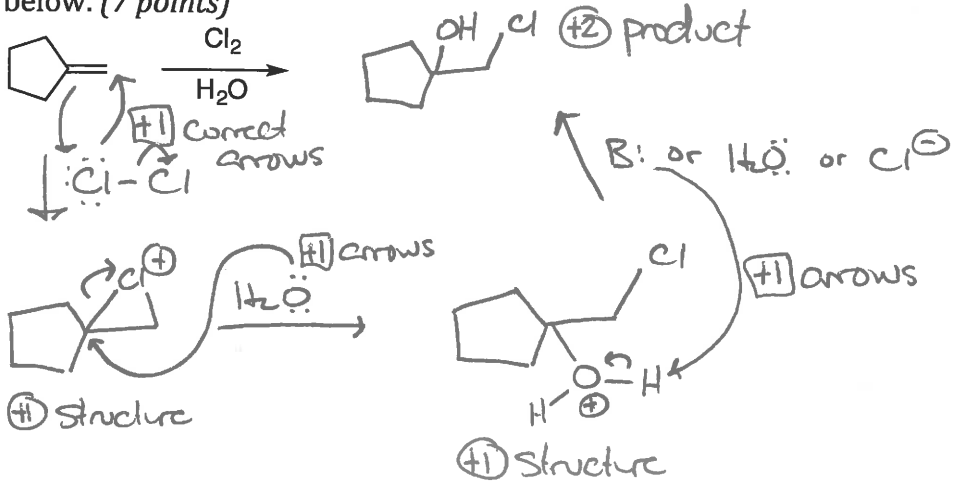
13. Fill in the missing reagents and structures in the synthetic scheme shown below. *(2 points each)*

(14)



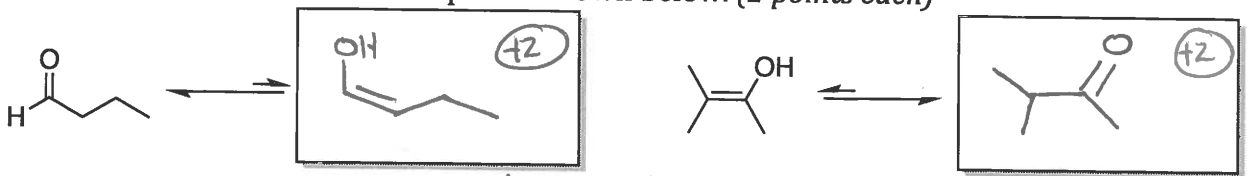
14. Predict the product and show the complete electron pushing mechanism for the reaction shown below. *(7 points)*

(7)

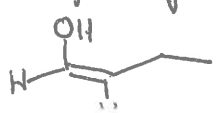


15. Draw the tautomer for each compound shown below. *(2 points each)*

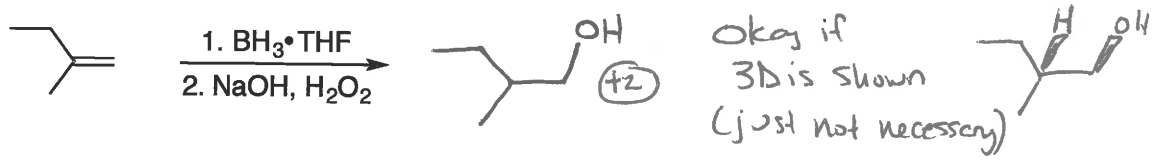
(4)

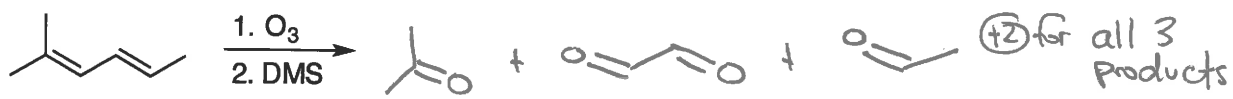


they may draw in H's

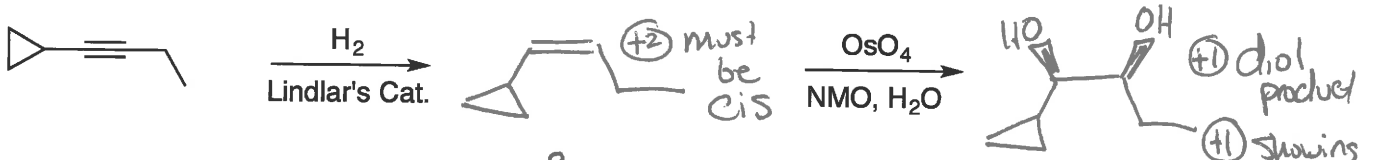


16. Predict the major organic product(s) for each reaction shown below. Show stereochemistry where appropriate. If enantiomers are formed, you only need to draw one enantiomer. *(2 points each)*

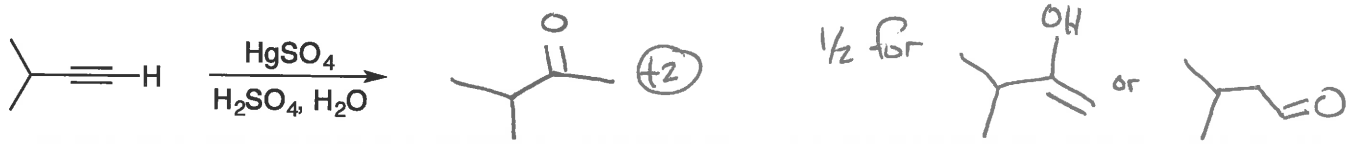
a. 

b. 

c. 

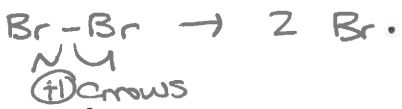
d. 

e. 

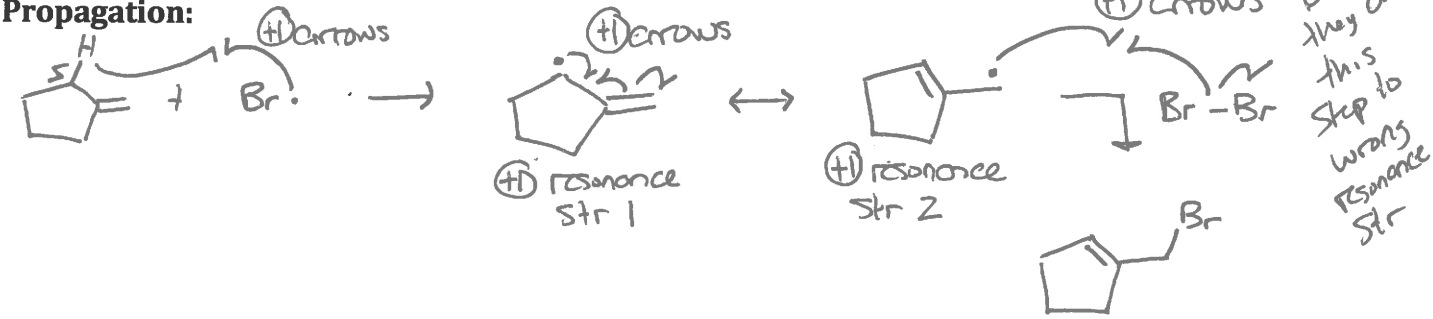
f. 

17. Predict the major product and draw the electron pushing mechanism for the allylic bromination shown below. You do not need to show how Br_2 is formed from NBS. *(8 points)*

Initiation:



Propagation:

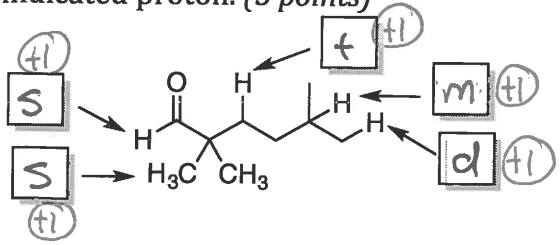


Termination: (show one possibility)

18. For the compound shown below, predict the multiplicity (i.e. singlet, doublet, etc.) for each indicated proton. *(5 points)*

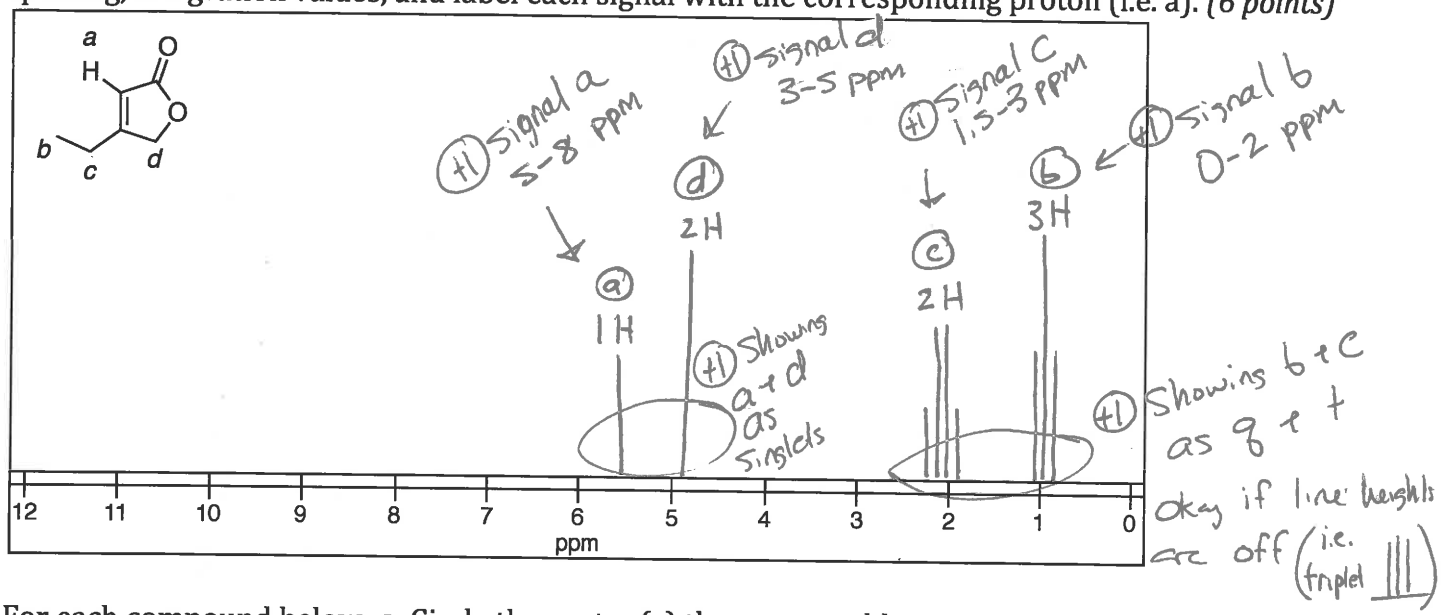
s, d, t

(5)



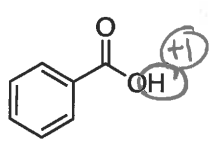
19. Draw a representative 1H NMR spectrum for the compound shown below. Be sure to show correct splitting, integration values, and label each signal with the corresponding proton (i.e. a). *(6 points)*

(6)

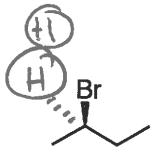


20. For each compound below: **a.** Circle the proton(s) that you would expect to be the most downfield (you may need to draw in the protons). **b.** Determine the number of distinct protons in each structure. *(3 points each)*

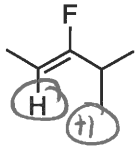
(9)



4 distinct H



5 distinct H



4 distinct H

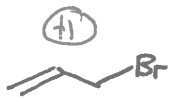
21. Draw two additional resonance structures for the radical shown below. *(2 points)*

(2)

22. Draw representative structures for each of the following: *(1 point each)*

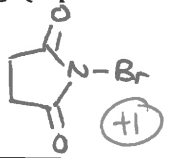
(4)

vinyl radical



allylic bromide

carbene



NBS
(+1 bonus)