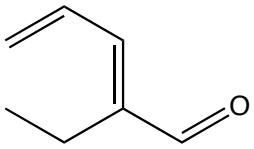
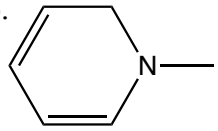
Name _____ Test 3 (5/6)
CHEM 0201 (Organic) Spring 2019

1. (12 pts.) Draw resonance contributors for the following structures. Do not draw any structures that would be considered insignificant contributors to the resonance hybrid.

a.



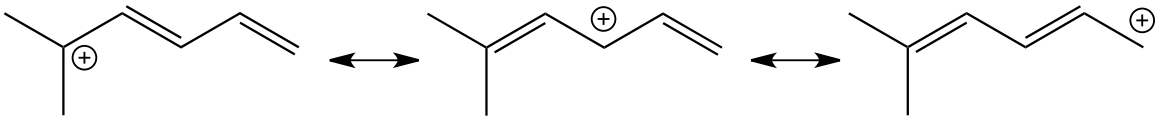
b.



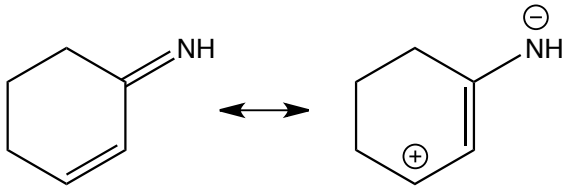
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

2. (a. 12 pts.) Rank the following resonance contributes in order of decreasing contribution to the resonance hybrid. **(b. 12 pts.)** Draw the resonance hybrid.

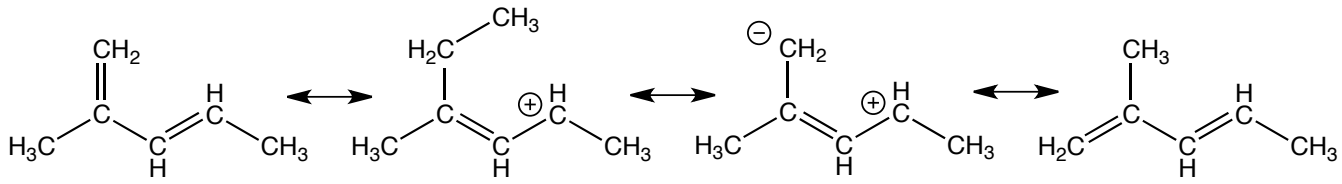
a.

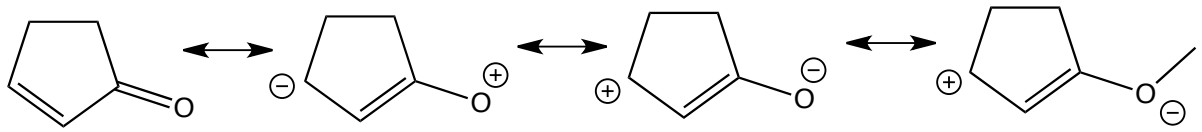


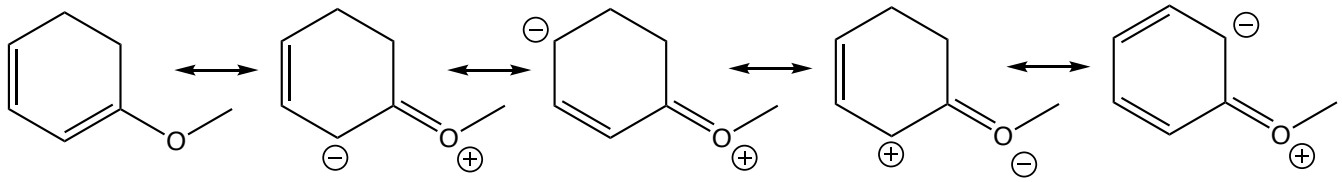
b.



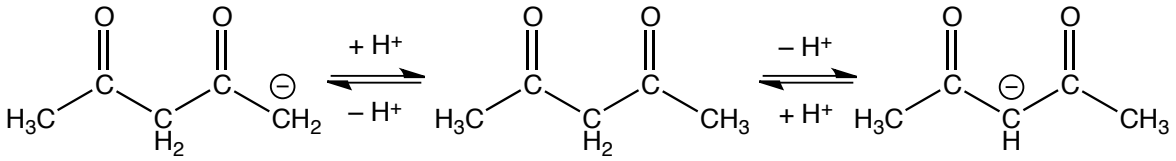
3. (10 pts.) For each of the molecules on the left, possible resonance contributors are drawn to the right. Some are valid, some are considered insignificant contributors, and some are simply incorrect. Label each contributor as valid, insignificant, or incorrect.



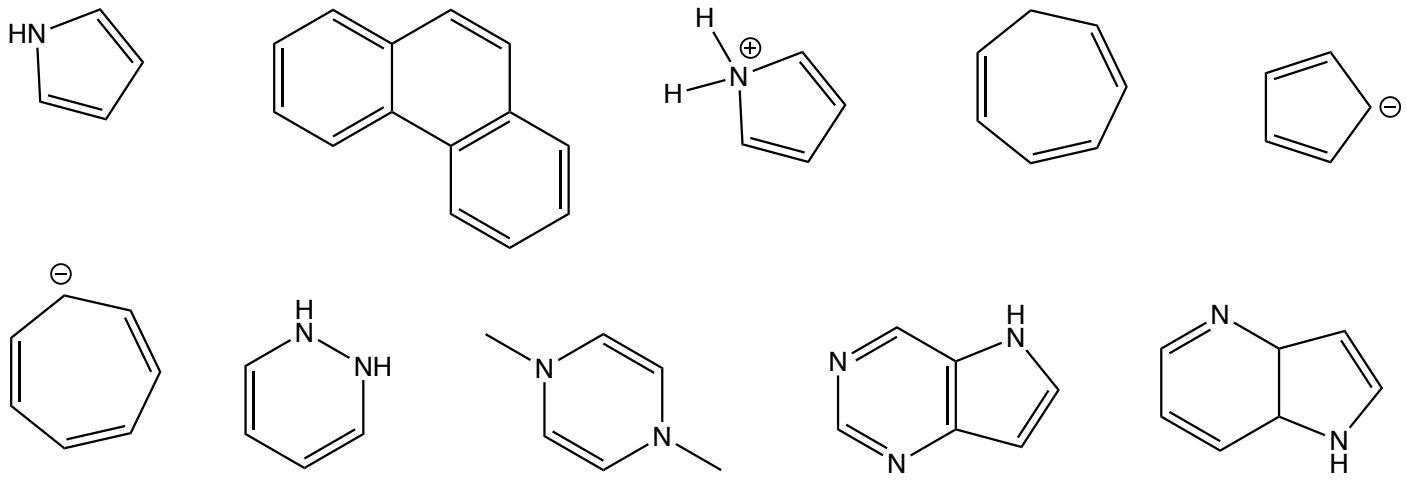




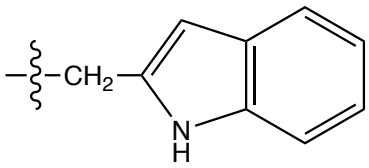
4. (12 pts.) Hydrogen atoms bonded to carbons that are adjacent to carbonyls, the so-called α-H, can be abstracted by reasonably strong bases. Explain why the α-H atoms on the CH_2 can be more easily attracted by a base than the α-H atoms on the CH_3 in the following molecule.



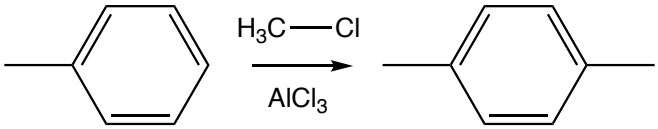
5. (10 pts.) Label the following molecules as aromatic, antiaromatic, or neither.



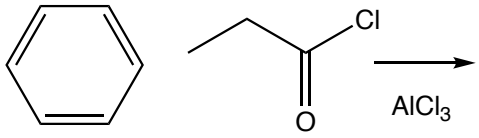
6. (12 pts.) The amino acid tryptophan has a side chain that does not act as a base even though there is a trivalent nitrogen atom in the side chain (trivalent means bonded to three other atoms). Explain why the tryptophan side chain is not basic in spite of the presence of a trivalent nitrogen atom.

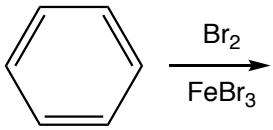


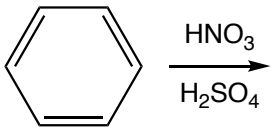
7. (12 pts.) Draw a mechanism for the following electrophilic aromatic substitution (EAS) reaction. Remember to draw electron movement arrows.

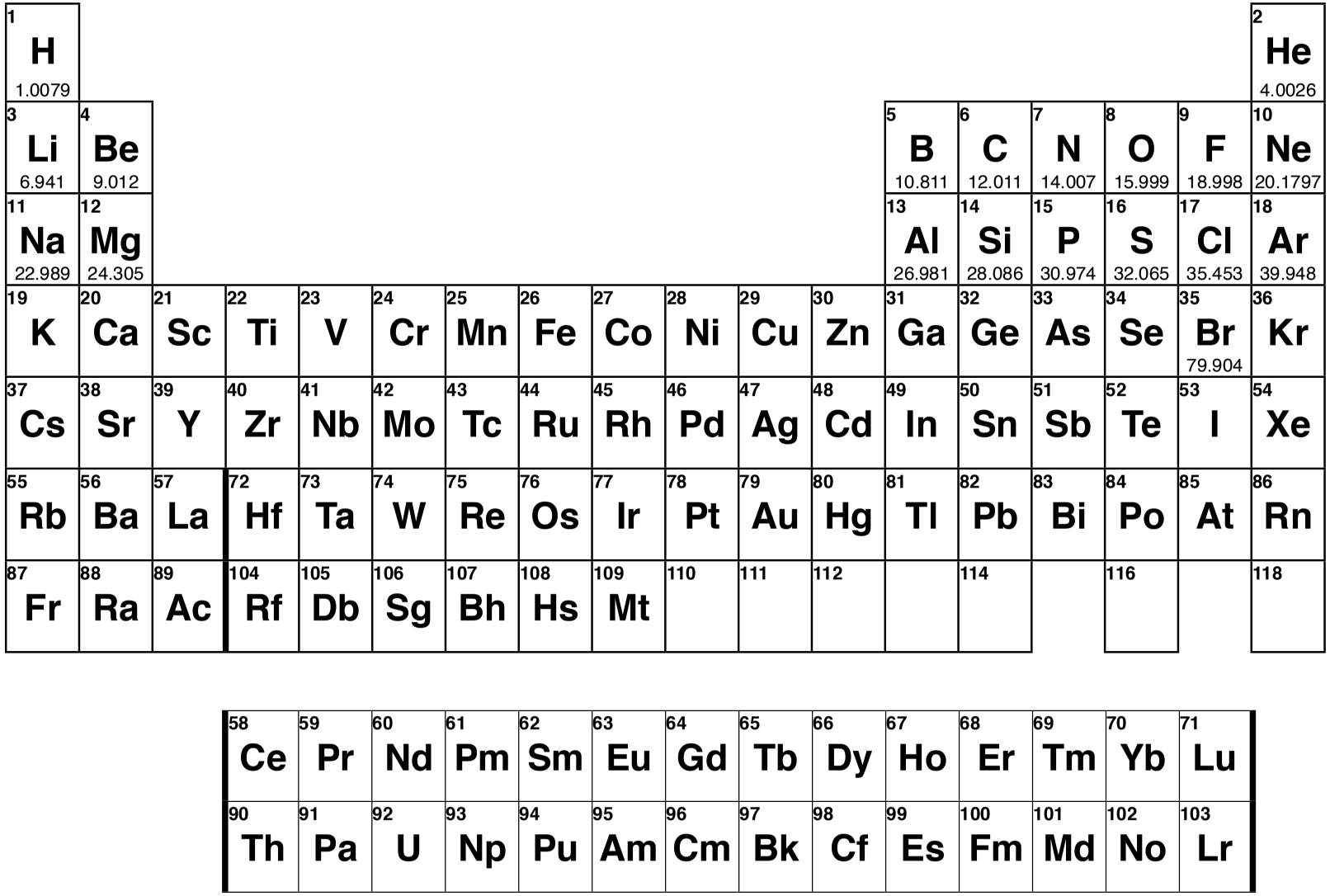


8. (6 pts. ea.) Predict the products of the following EAS reactions.








1 H 1.0079
2 He 4.0026
3 Li 6.941
4 Be 9.012
5 B 10.811
6 C 12.011
7 N 14.007
8 O 15.999
9 F 18.998
10 Ne 20.1797
11 Na 22.989
12 Mg 24.305
13 Al 26.981
14 Si 28.086
15 P 30.974
16 S 32.065
17 Cl 35.453
18 Ar 39.948
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br 79.904
36 Kr
37 Cs
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Rb
56 Ba
57 La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 Ac
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110
111
112
114
116
118
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No
103 Lr