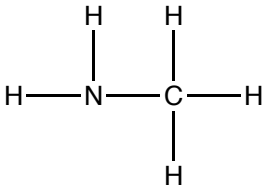
Name _____ Test 1 (10/8)
CHEM 0201 (Organic) Fall 2021

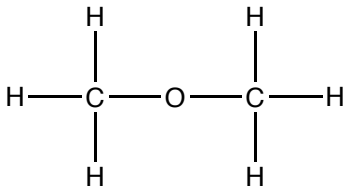
1. (16 pts.) Draw Lewis structures for the following condensed structures.

$CH_3OCH(CH_3)_2$ $CH(O)CH_3$

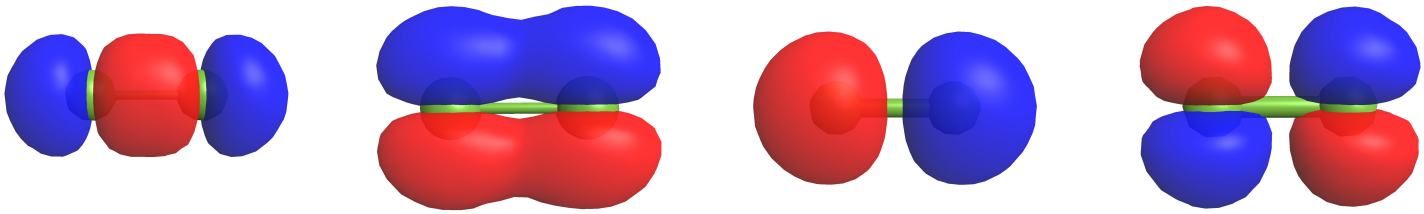
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

2. (10 pts.) Using wedge (◄) and dashed (┈┈) bonds where appropriate, create three-dimensional Kekulé structures for the following Kekulé structures.



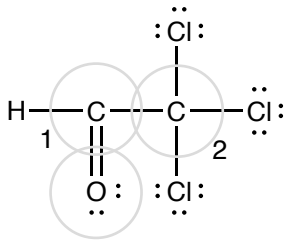


3. (12 pts.) Label (σ, π, bonding, and/or antibonding) the following molecular orbitals for a molecule of F_2. The two green spheres, which are connected by a green cylinder, represent the nuclei of the F atoms.



4. (10 pts) Determine the hybridization of the circled atoms in the structures drawn below. Lewis, Kekulé, and condensed structures have been provided.

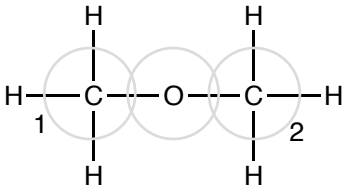
a.



C(1)_____ C(2)_____

O _____

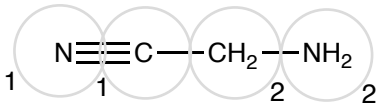
b.



C(1)_____ C(2)_____

O _____

c.



C(1)_____ C(2)_____

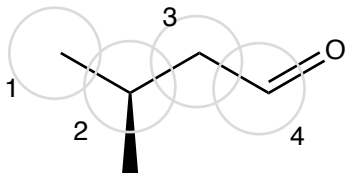
N(1)_____ N(2) _____

5. a. (4 pts.) Determine the hybridization of the circled atoms in the following skeletal structure.
b. (4 pts.) Determine the degree of substitution (1, 2°, 3°, or 4°) of the circled C atoms.

hybridization

C(1)_____ C(2)_____

C(3)_____ C(4) _____

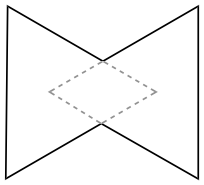


degree of substitution

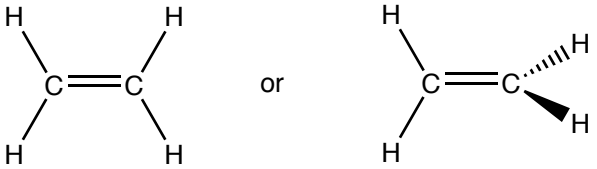
C(1)_____ C(2)_____

C(3)_____ C(4) _____

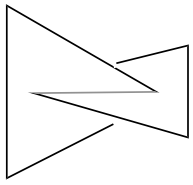
6. (12 pts.) In General Chemistry we learned that atoms with a steric number of three (like the C atoms below) orient their bonds so that the bonds point towards the corners of a triangle. Both representations drawn below have trigonal planar C atoms, but we know from valance bond theory that only one of them is correct.



co-planar triangles



or



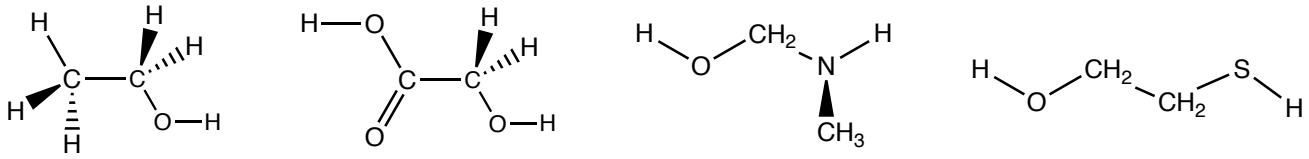
perpendicular triangles

Identify the correct structure and using valence bond theory explain your choice. In your explanation remember to identify the orbitals that are being used to form the C to C bonds.

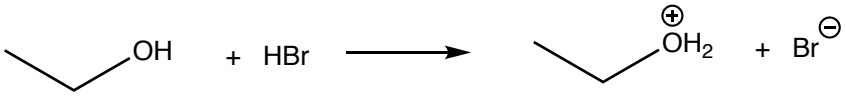
7. (10 pts.) Based on the provided pK_a values rank the following molecules in order of decreasing acidity; that is, label the strongest acid with a "1", the next strongest with a "2", and so on.

H_2SO_4	CH_3CCH	CH_3CO_2H	ClC_6H_4OH	C_6H_5OH
($pK_a \cong -3$)	($pK_a = 25$)	($pK_a = 4.75$)	($pK_a = 8.95$)	($pK_a = 10.0$)

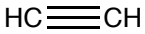
8. (12 pts.) For each of the following structures, circle the H that would most easily be removed by a base.



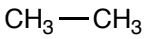
9. (10 pts.) In the following reaction label the molecule that acts as a Brønsted-Lowry base and molecule that acts as a Brønsted-Lowry acid.



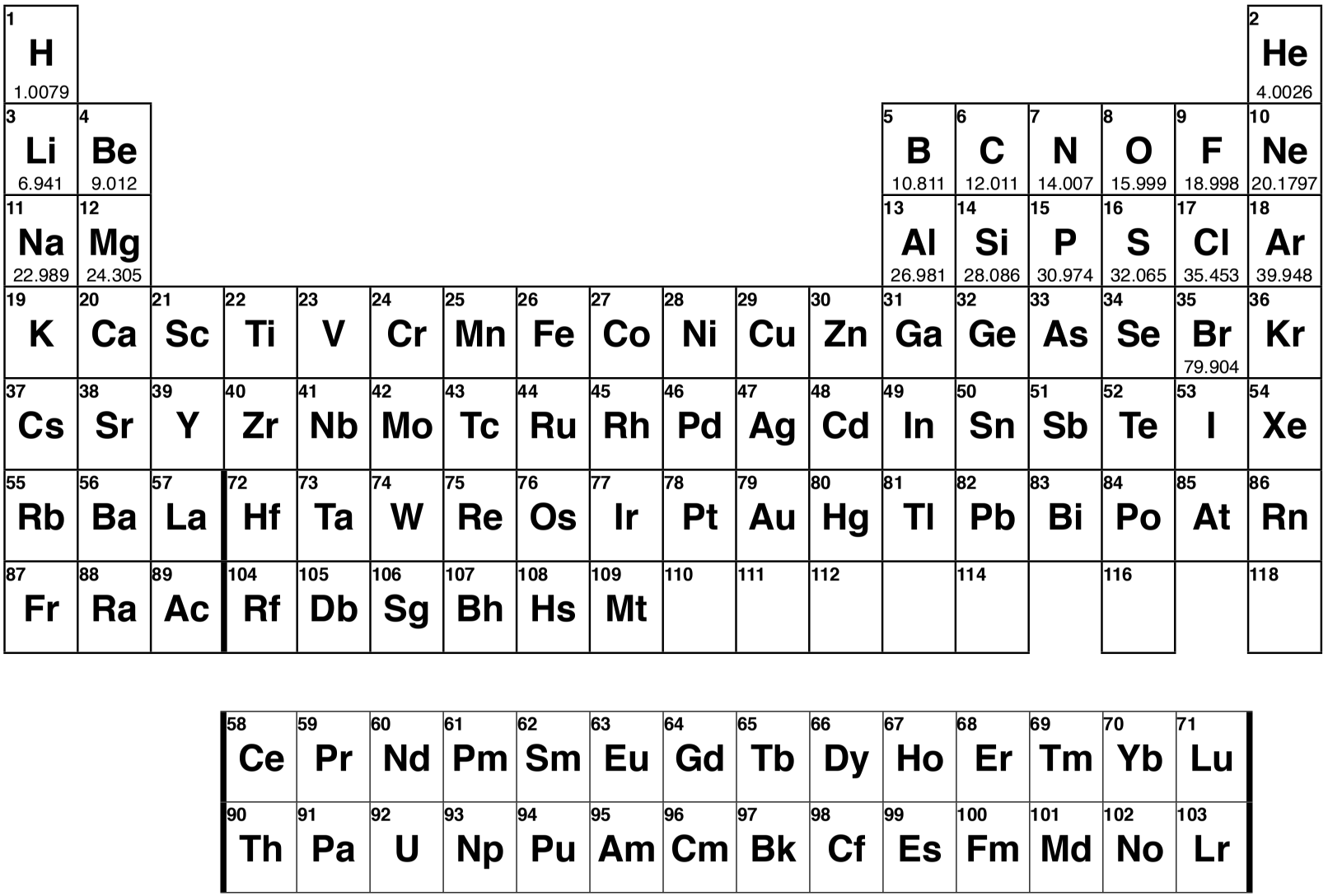
10. Ethyne is a stronger Brønsted-Lowry acid than ethane. Determine the hybridization of the C atoms on both molecules and explain why ethyne is the stronger acid.



ethyne



ethane


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