Name ____________________________   Test 3 (12/2)

CHEM 0201 (Organic)   Fall 2022

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. ________

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

7. ________

8. ________

9. ________

10. ______

11. ______

a. Label the reactant(s) with an “a”.

b. Label the product(s) with a “b”.

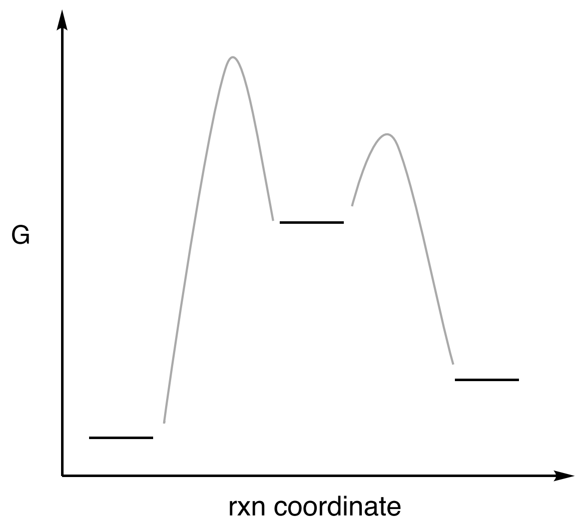
c. Label the intermediate(s) with a “c”.

d. Label the transition state(s) with a “d”.

e. Does this reaction absorb or release energy?

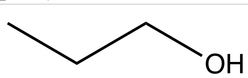
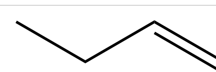
f. Would this reaction have a positive or negative $\Delta G$?

g. Does the equilibrium favor the reactants or products.

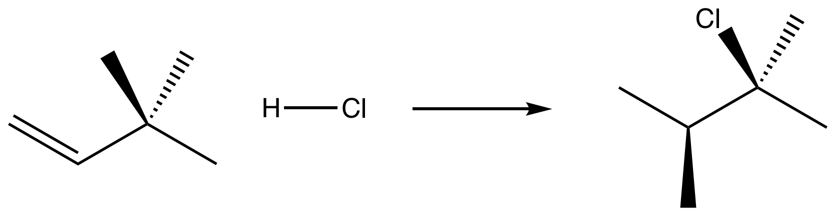



h. How many steps would the mechanism of this reaction have?

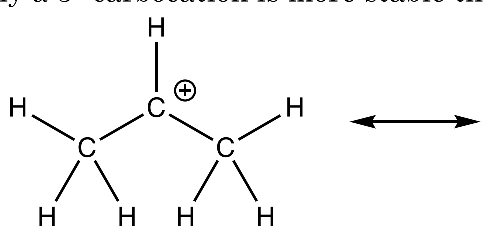
3. (16 pts.) Determine whether the following can react as nucleophiles, electrophiles, or neither.

| | | | |
|---|---|---|---|
|  | $CH_2CHCH_2CH_3$ | $HOCH_3$ | $H^+$ |
| $Cl^-$ | $H_2SO_4$ | $CH_3CH_2CH_2CH(CH_3)_2$ |  |

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

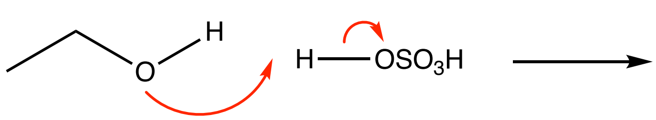



5. a. (6 pts.) A secondary carbocation is drawn below. Draw a resonance contributor that shows how a neighboring σ bond stabilizes the carbocation through hyperconjugation. (**b. 6 pts.**) Briefly, explain why a 3° carbocation is more stable than a 2° carbocation.

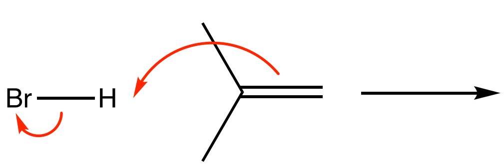



6. (6 pts. each) Draw the structures that result based on the electron movement arrow that are shown.

a.




b.



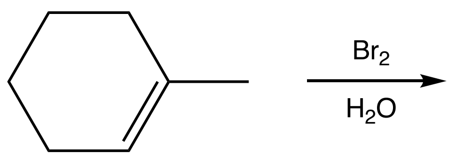
7. a. (3 pts.) Products of a borane electrophilic addition reaction are formed via syn addition, anti addition, or both?

b. (3 pts.) Products of a $H^+$ initiated electrophilic addition reaction are formed via syn addition, anti addition, or both?

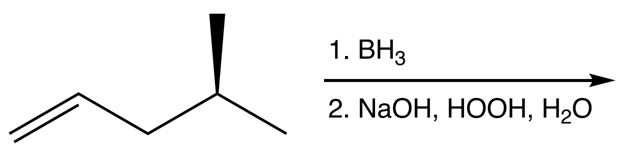
c. (3 pts.) Products of a $Cl_2$ or $Br_2$ initiated electrophilic addition reaction are formed via syn addition, anti addition, or both?

(8 pts. ea.) Predict the major organic product(s) for the following reactions. Remember to indicate the stereochemistry of the product(s) using wedge (), dashed (), or squiggly () 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).

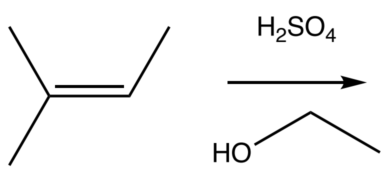
8.



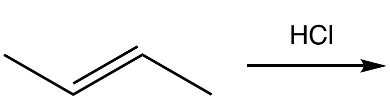

9.




10.




11.



| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |