

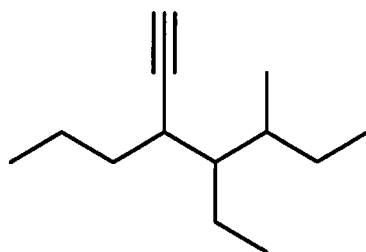
Name \_\_\_\_\_

*If you do NOT want your graded exam placed in the box outside my office, then please check here \_\_\_\_\_*

*1-10 are True / False (10pts)*

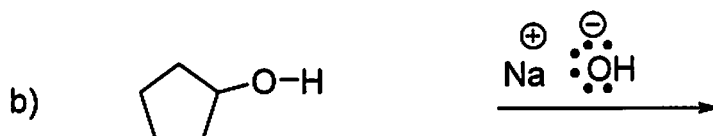
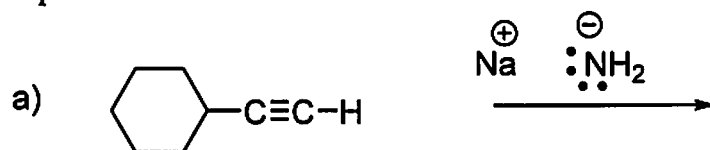
- 1) Alkenes contain a Carbon-Carbon triple bond.
- 2) Pentan-3-ol is a chiral molecule.
- 3) Pent-1-yne is an internal alkyne.
- 4) An ester is generated by substituting an OH section in an appropriate acid, with an OR group.
- 5) Cyclopropanol has six Hydrogens.
- 6) Thiols are Sulfur analogs of Alcohols.
- 7) All alkynes have at least three  $\pi$  bonds.
- 8) Cyclopropanol is a tertiary alcohol.
- 9) An alkyne triple bond does not need a Z or E stereodescriptor because the linear geometry of the bond does not lead to the existence of stereoisomers.
- 10) Organometallic reagents have a metal and a Carbon covalently bound together.

11) a) Name this molecule in IUPAC form. (3pts)



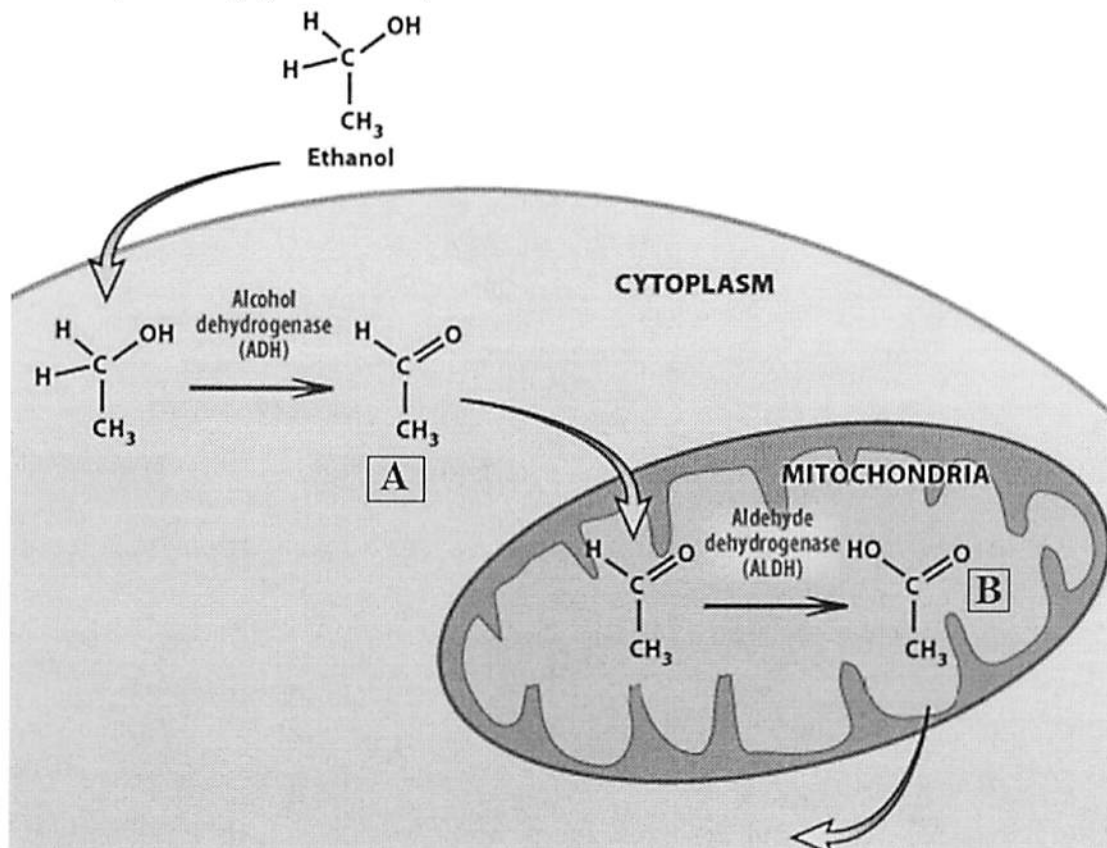
b) Using any appropriate method or representation (line angle, Lewis, sticks and wedges, etc.) precisely draw *cis-cyclobutane-1,2-diol*. (3pts)

12) (1+1+2=4pts) a) Draw the (organic) products of the following two deprotonations.



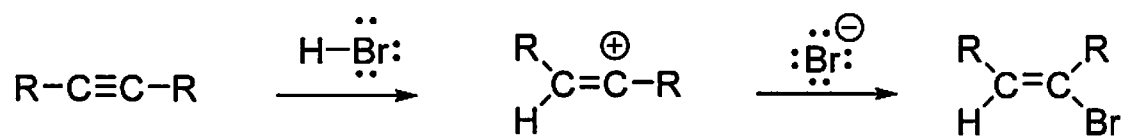
b) Draw in the (two) curly arrows to show the mechanism for **one** of the above deprotonations.

13) (6 pts) When humans drink *ethanol* it causes intoxication. For survival the human body moves the intoxicant alcohol from your stomach (GI tract) to your liver, where the enzyme “alcohol dehydrogenase” converts it into molecule **A** which is relatively toxic causing headaches, nausea and increased heart rate (i.e. hangovers). Then a second liver enzyme called “aldehyde dehydrogenase”, present in the mitochondria, converts **A** into molecule **B** which is non-toxic, and also much more water soluble so that it can be expelled by your kidneys.



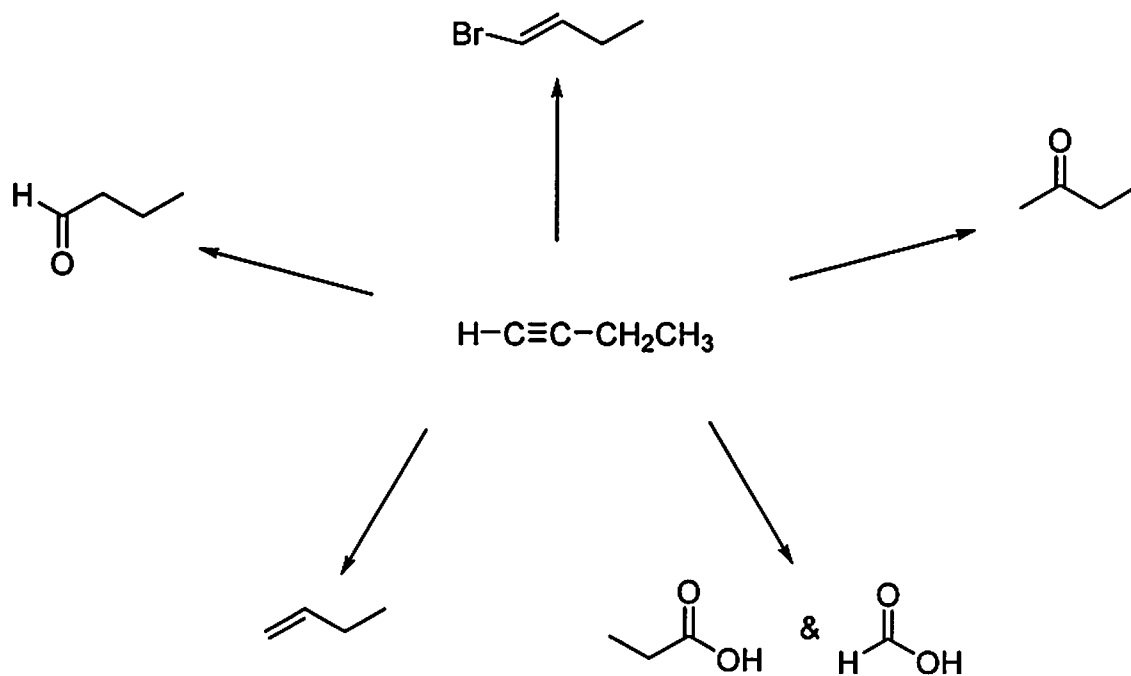
- What functional group is molecule A?
- What functional group is molecule B?
- Provide a reagent (or reagents) that also would convert Ethanol into A.
- Is the conversion of Ethanol into A an *oxidation* / *reduction* / *neither* ?
- Provide a reagent (or reagents) that would convert A back into Ethanol.
- Is the conversion of A into B an *oxidation* / *reduction* / *neither* ?

14) (3+1=4pts) a) Draw in the curly arrows to show the mechanism of the following electrophilic addition reaction.

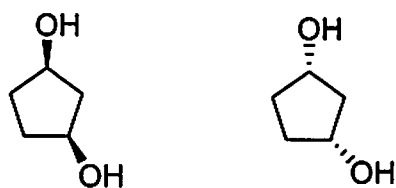


b) In terms of *regiochemistry*, how would you describe this reaction?

15) Provide the sets of reagents for the following transformations. (10 pts)



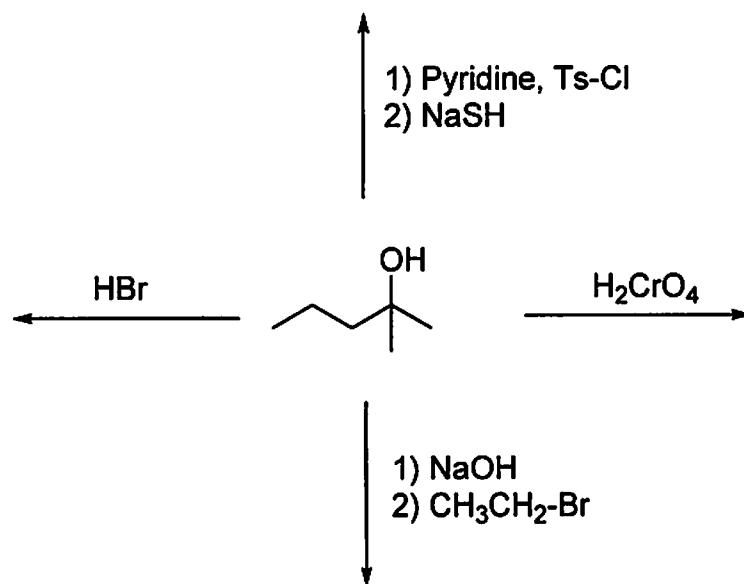
16) a) Are these two molecules the *same* or *different*? (1pt)



b) Provide the type of isomerism relating the two below molecules. (1pt)

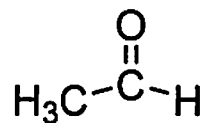


17) Draw the products generated in the following reactions. (4x2=8pts)

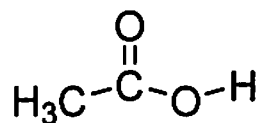


**\*\*BONUS QUESTION (up to 2 points)\*\***

Looking back at question 13, why do you think molecule B is more *water soluble* than molecule A (and thus more easily expelled in urine)?



**A**



**B**

|                      |                       |                       |                            |                      |                         |                        |                       |                         |                        |                      |                        |                            |                            |                            |                            |                            |                     |
|----------------------|-----------------------|-----------------------|----------------------------|----------------------|-------------------------|------------------------|-----------------------|-------------------------|------------------------|----------------------|------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------|
| hydrogen<br>1<br>H   | beryllium<br>4<br>Be  | scandium<br>21<br>Sc  | titanium<br>22<br>Ti       | vanadium<br>23<br>V  | chromium<br>24<br>Cr    | manganese<br>25<br>Mn  | iron<br>26<br>Fe      | cobalt<br>27<br>Co      | nickel<br>28<br>Ni     | copper<br>29<br>Cu   | zinc<br>30<br>Zn       | boron<br>5<br>B            | carbon<br>6<br>C           | nitrogen<br>7<br>N         | oxygen<br>8<br>O           | fluorine<br>9<br>F         | helium<br>2<br>He   |
| lithium<br>3<br>Li   | sodium<br>11<br>Na    | yttrium<br>39<br>Y    | zirconium<br>40<br>Zr      | niobium<br>41<br>Nb  | molybdenum<br>42<br>Mo  | technetium<br>43<br>Tc | ruthenium<br>44<br>Ru | rhodium<br>45<br>Rh     | palladium<br>46<br>Pd  | silver<br>47<br>Ag   | cadmium<br>48<br>Cd    | aluminum<br>13<br>Al       | silicon<br>14<br>Si        | phosphorus<br>15<br>P      | sulfur<br>16<br>S          | chlorine<br>17<br>Cl       | neon<br>10<br>Ne    |
| potassium<br>19<br>K | calcium<br>20<br>Ca   | zirconium<br>38<br>Zr | niobium<br>40<br>Nb        | niobium<br>41<br>Nb  | molybdenum<br>42<br>Mo  | technetium<br>43<br>Tc | ruthenium<br>44<br>Ru | rhodium<br>45<br>Rh     | palladium<br>46<br>Pd  | silver<br>47<br>Ag   | cadmium<br>48<br>Cd    | indium<br>49<br>In         | tin<br>50<br>Sn            | antimony<br>51<br>Sb       | tellurium<br>52<br>Te      | iodine<br>53<br>I          | argon<br>18<br>Ar   |
| rubidium<br>37<br>Rb | strontium<br>38<br>Sr | yttrium<br>39<br>Y    | niobium<br>41<br>Nb        | niobium<br>41<br>Nb  | molybdenum<br>42<br>Mo  | technetium<br>43<br>Tc | ruthenium<br>44<br>Ru | rhodium<br>45<br>Rh     | palladium<br>46<br>Pd  | silver<br>47<br>Ag   | cadmium<br>48<br>Cd    | tin<br>50<br>Sn            | lead<br>82<br>Pb           | bismuth<br>83<br>Bi        | polonium<br>84<br>Po       | astatine<br>85<br>At       | krypton<br>36<br>Kr |
| cesium<br>55<br>Cs   | barium<br>56<br>Ba    | lutetium<br>71<br>Lu  | hafnium<br>72<br>Hf        | tantalum<br>73<br>Ta | wolfram<br>74<br>W      | rhenium<br>75<br>Re    | osmium<br>76<br>Os    | iridium<br>77<br>Ir     | platinum<br>78<br>Pt   | gold<br>79<br>Au     | mercury<br>80<br>Hg    | thallium<br>81<br>Tl       | lead<br>82<br>Pb           | bismuth<br>83<br>Bi        | polonium<br>84<br>Po       | astatine<br>85<br>At       | xenon<br>54<br>Xe   |
| francium<br>87<br>Fr | radium<br>88<br>Ra    | lutetium<br>71<br>Lu  | rutherfordium<br>104<br>Rf | dubnium<br>105<br>Db | seaborgium<br>106<br>Sg | bohrium<br>107<br>Bh   | hassium<br>108<br>Hs  | meitnerium<br>109<br>Mt | unnilium<br>110<br>Uun | ununium<br>111<br>Uu | unbibium<br>112<br>Uub | unnilquadium<br>114<br>Uuq | unnilquadium<br>114<br>Uuq | unnilquadium<br>114<br>Uuq | unnilquadium<br>114<br>Uuq | unnilquadium<br>114<br>Uuq | radon<br>86<br>Rn   |
|                      |                       |                       |                            |                      |                         |                        |                       |                         |                        |                      |                        |                            |                            |                            |                            |                            |                     |

\* Lanthanide series

\*\* Actinide series

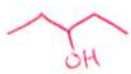


|                       |                    |                          |                       |                        |                      |                      |                        |                     |                        |                     |                    |                     |                       |                      |                     |                          |                    |                       |                       |                       |                    |                       |                         |                         |                      |                          |                       |        |
|-----------------------|--------------------|--------------------------|-----------------------|------------------------|----------------------|----------------------|------------------------|---------------------|------------------------|---------------------|--------------------|---------------------|-----------------------|----------------------|---------------------|--------------------------|--------------------|-----------------------|-----------------------|-----------------------|--------------------|-----------------------|-------------------------|-------------------------|----------------------|--------------------------|-----------------------|--------|
| lanthanum<br>57<br>La | cerium<br>58<br>Ce | praseodymium<br>59<br>Pr | neodymium<br>60<br>Nd | promethium<br>61<br>Pm | samarium<br>62<br>Sm | europium<br>63<br>Eu | gadolinium<br>64<br>Gd | terbium<br>65<br>Tb | dysprosium<br>66<br>Dy | holmium<br>67<br>Ho | erbium<br>68<br>Er | thulium<br>69<br>Tm | ytterbium<br>70<br>Yb | actinium<br>89<br>Ac | thorium<br>90<br>Th | protactinium<br>91<br>Pa | uranium<br>92<br>U | neptunium<br>93<br>Np | plutonium<br>94<br>Pu | americium<br>95<br>Am | curium<br>96<br>Cm | berkelium<br>97<br>Bk | californium<br>98<br>Cf | einsteinium<br>99<br>Es | fermium<br>100<br>Fm | mendelevium<br>101<br>Md | nobelium<br>102<br>No |        |
| 138.91                | 140.12             | 140.91                   | 144.24                | 144.91                 | 150.35               | 151.96               | 157.25                 | 158.93              | 162.50                 | 164.93              | 167.26             | 168.93              | 173.04                | 227.03               | 232.04              | 231.04                   | 238.03             | 237.04                | 244.06                | 243.06                | 247.07             | 247.07                | 247.07                  | 251.08                  | 252.08               | 257.10                   | 258.10                | 259.10 |

Name

TEQUILA MOCKINGBIRD

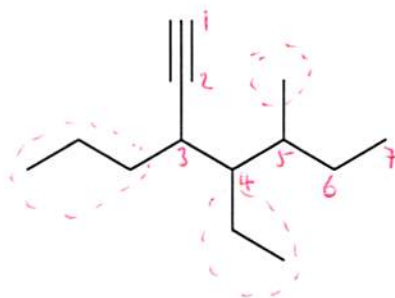
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1-10 are True / False (10pts)

- 1) Alkenes contain a Carbon-Carbon triple bond. *false*
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- 3) Pent-1-yne is an internal alkyne. *false*  

- 4) An ester is generated by substituting an OH section in an appropriate acid, with an OR group. *T*
- 5) Cyclopropanol has six Hydrogens. *T*  

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- 9) An alkyne triple bond does not need a Z or E stereodescriptor because the linear geometry of the bond does not lead to the existence of stereoisomers. *T*
- 10) Organometallic reagents have a metal and a Carbon covalently bound together. *T*



11) a) Name this molecule in IUPAC form. (3pts)

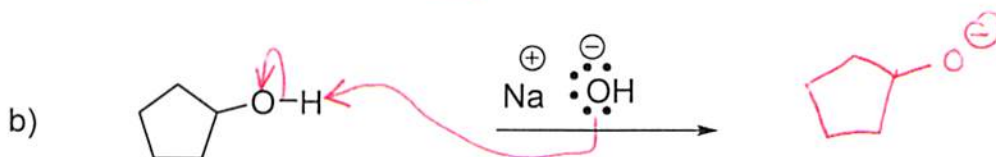
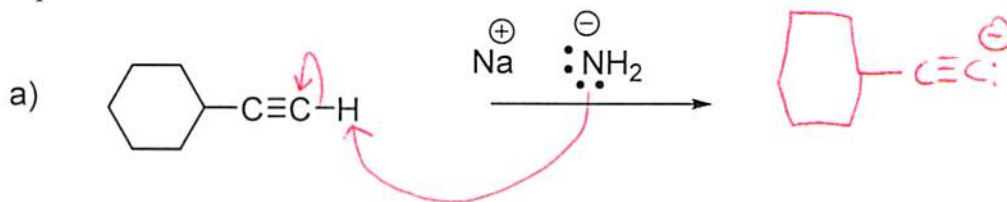


4-Ethyl-5-methyl-3-Propylhept-1-yne

b) Using any appropriate method or representation (line angle, Lewis, sticks and wedges, etc.) precisely draw *cis*-cyclobutane-1,2-diol. (3pts)

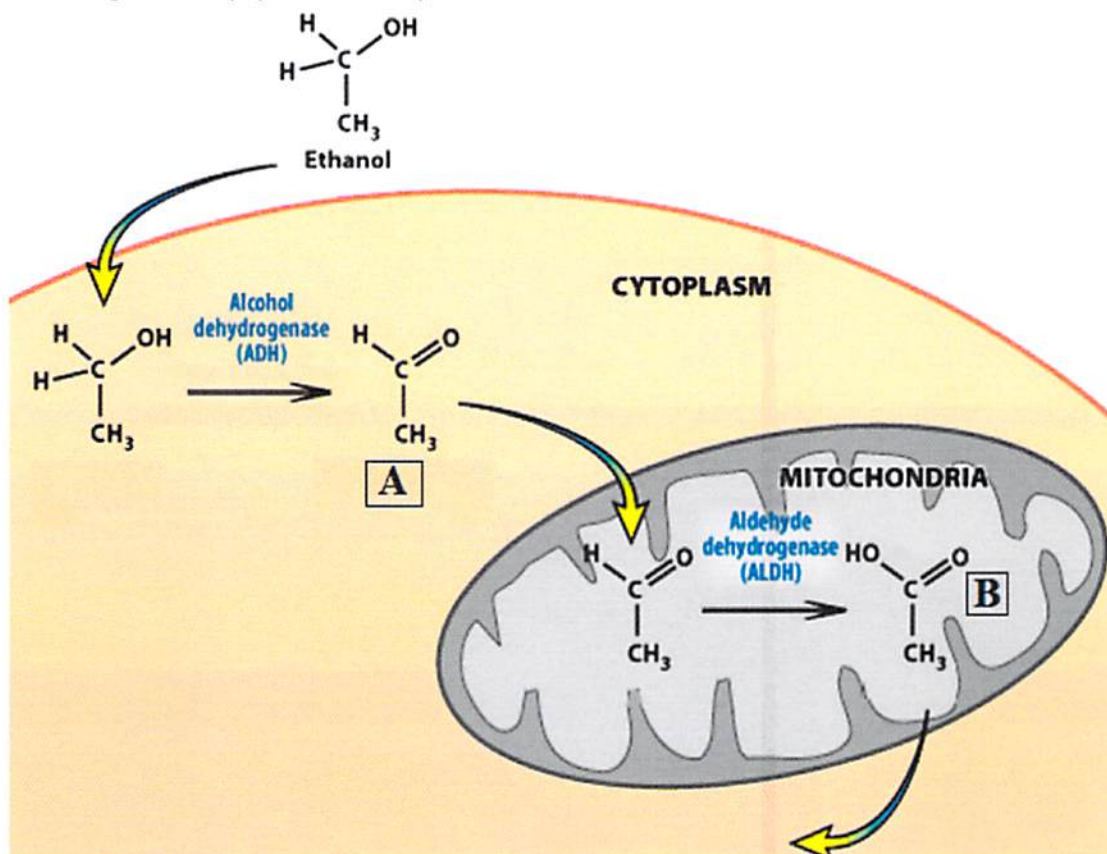


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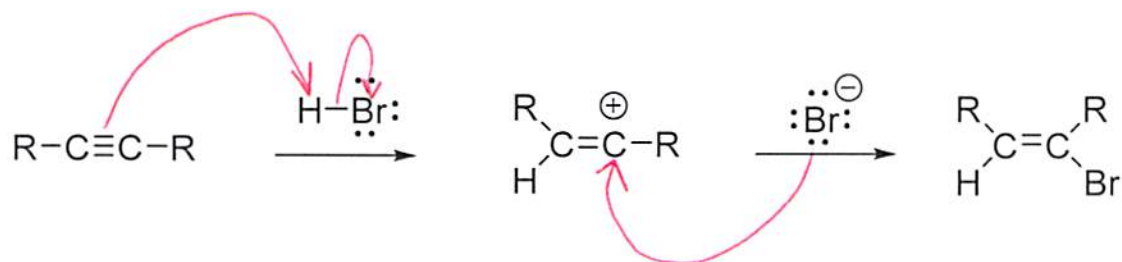
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- a) What functional group is molecule A? *Aldehyde*
- b) What functional group is molecule B? *Carboxylic Acid*
- c) Provide a reagent (or reagents) that also would convert Ethanol into A. *P.C.C*
- d) Is the conversion of Ethanol into A an oxidation / reduction / neither ?
- e) Provide a reagent (or reagents) that would convert A back into Ethanol.  *$\text{NaBH}_4, \text{H}_2\text{O}$   
or  $\text{LiAlH}_4, \text{H}_2\text{O}$*
- f) Is the conversion of A into B an oxidation / reduction / neither ?

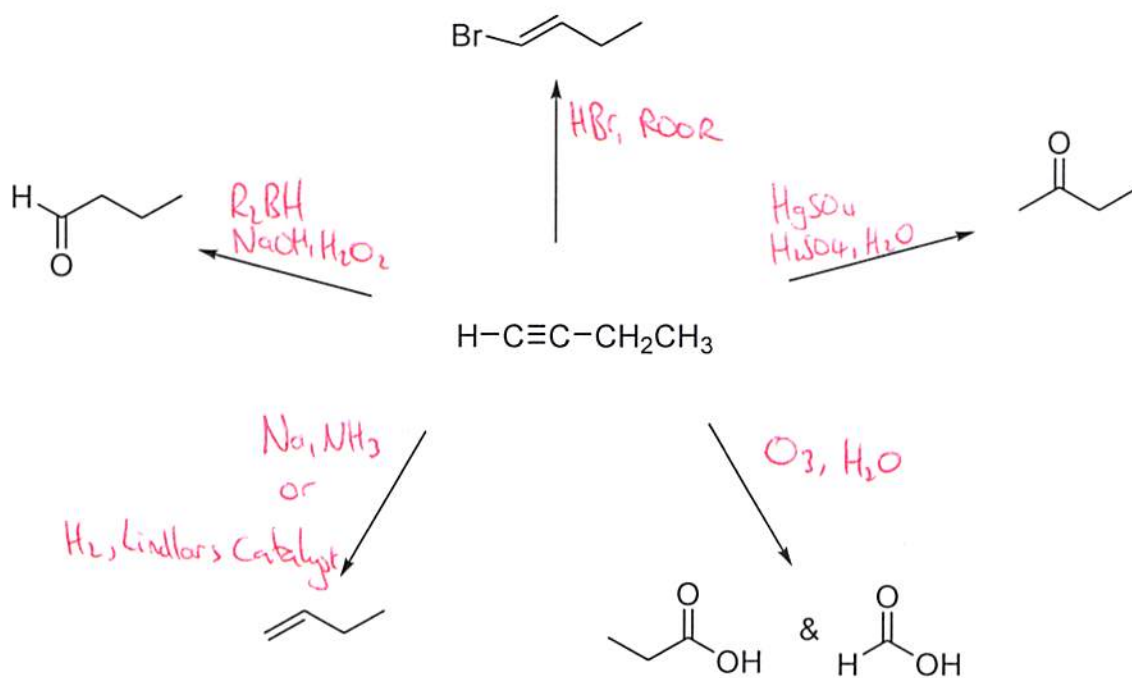
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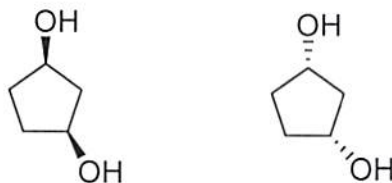
b) In terms of *regiochemistry*, how would you describe this reaction?

Not applicable, irrelevant, cannot tell.

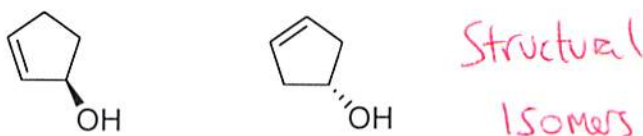
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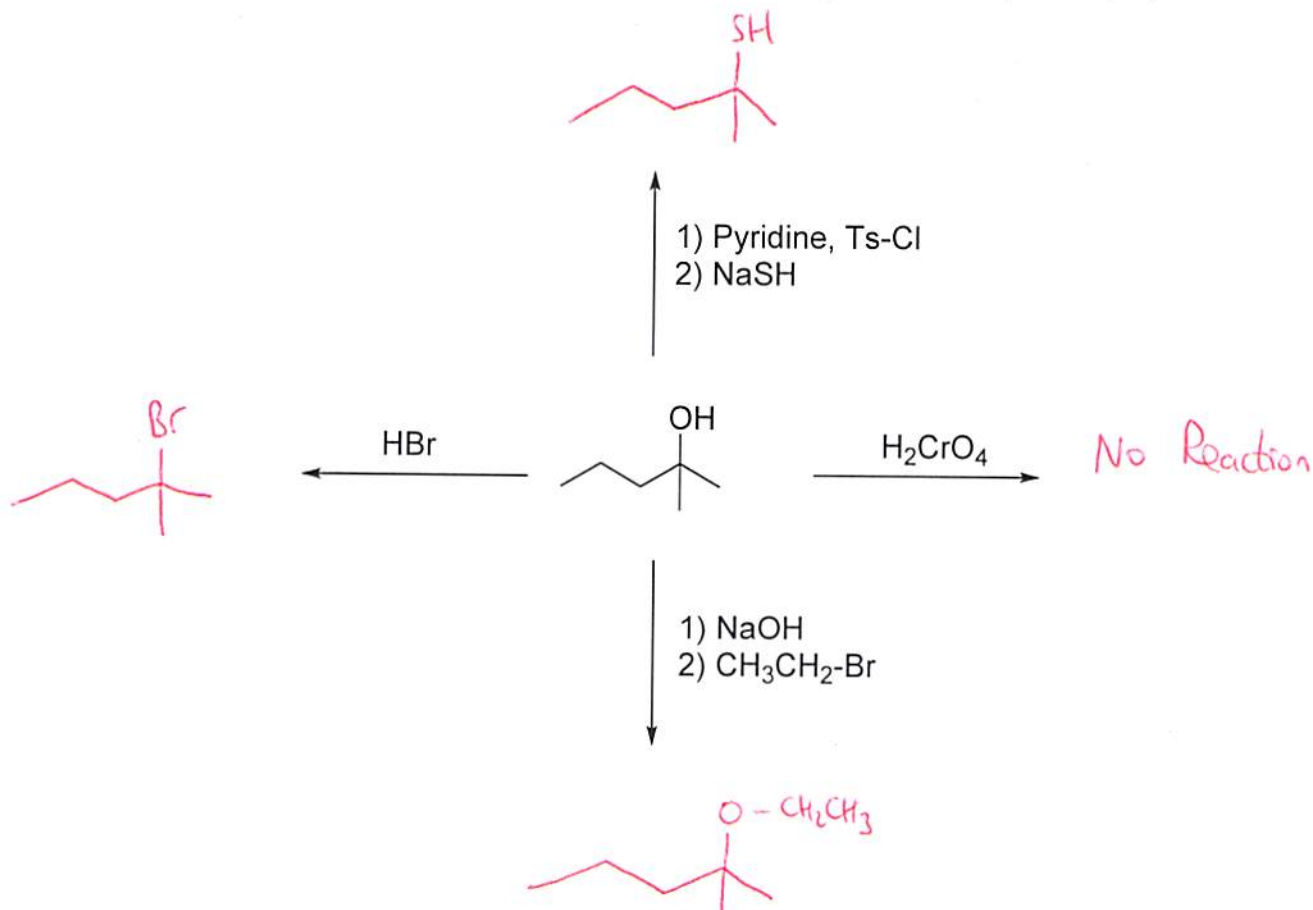
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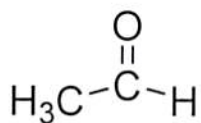


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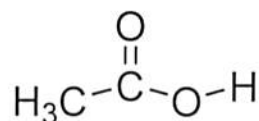


**\*\*BONUS QUESTION (up to 2 points)\*\***

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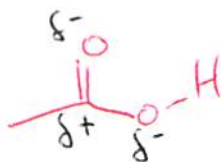


**A**



**B**

B is more water soluble because it is more polar and because of "Hydrogen bonding".



The carboxylic acid is more polar than the aldehyde due to more bonds to electronegative atoms.

Also the carboxylic acid can act as a 'hydrogen bond' acceptor, and a 'hydrogen bond' donor with water.

