

GOOD PROBLEM p 566 #12 (Nov 13 batch)

3. A chemist wishes to identify Compound **F**. She knows it has a molecular formula of  $C_4H_6$ , and the IR spectrum shows no peak in the  $2100-2300\text{ cm}^{-1}$  region. However the monochromator fails past  $2700\text{ cm}^{-1}$  so no information on C-H stretches is available. A quick trip to the polarimeter indicates that **F** is achiral.

Entering the lab, she first notes that **F** decolorises bromine water, and upon hydrogenation over a clean surface of platinum she collects a good yield of butane gas. Further reactions of **F** yield the following results:

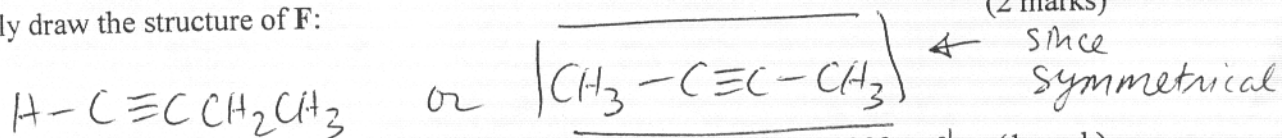
Indicate  
F  
is  
ALKYNE  
since  
G  
is  
alkene

i) careful stoichiometric hydrogenation over a poisoned catalyst produces a new material, **G**, which is also achiral.

ii) *syn*-Hydroxylation of **G** with osmium tetroxide in pyridine, followed by workup in aqueous sodium thiosulfate, yields **H**. Since **H** is also achiral, and cannot be resolved into chiral components, the chemist determines an unambiguous structure for **F**.

a) Is **F** an alkyne or alkene, or neither? Answer: ALKYNE (1 mark)

b) Neatly draw the structure of **F**: (2 marks)

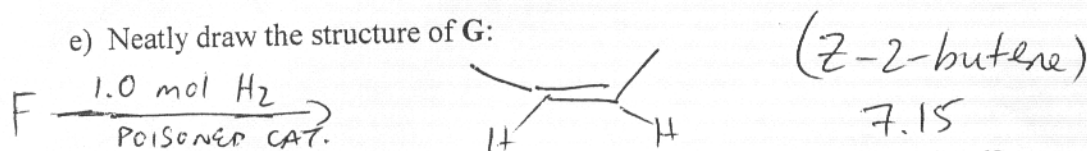


c) Explain in one sentence why **F** does not exhibit a stretch between  $2100-2300\text{ cm}^{-1}$ . (1 mark)

No  $C\equiv C$  stretch because **F** is symmetrical

d) Is **G** an alkyne or alkene, or neither? Answer: ALKENE (1 mark)

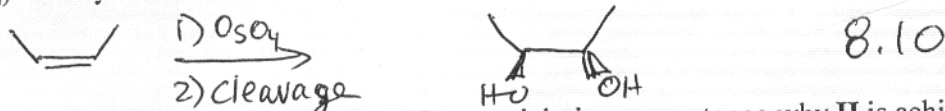
e) Neatly draw the structure of **G**: (2 marks)



f) Explain in one sentence why the other diastereomer of **G** is not isolated? (1 mark)

7.14A The hydrogenation reaction occurs at the metal surface and proceeds with *syn* stereoselectivity only (2 marks)

g) Neatly draw the structure of **H**: (2 marks)



h) Does **H** contain chiral atoms? If so, explain in one sentence why **H** is achiral. (1 mark)

Yes, **H** is meso 5.11A

i) Explain briefly how one could try to resolve **H** into individual chiral components. (1 mark)

One could attempt a chiral resolution by reacting **H** with a chiral molecule (eg. tartrate salts) and separating the resulting diastereomers 5.15