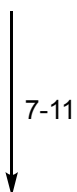
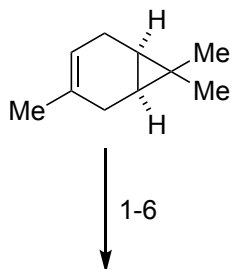


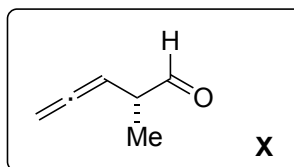
Nineteen-Step Total Synthesis of (+)-Phorbol

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- 1) NCS, DMAP
- 2) O_3 then thiourea
- 3) LiNap then HMPA, MeI then LiHMDS, **X**
- 4) Ethynylmagnesium bromide
- 5) TBSOTf, Et_3N then TMSOTf, Et_3N
- 6) $[RhCl(CO)_2]_2$, CO



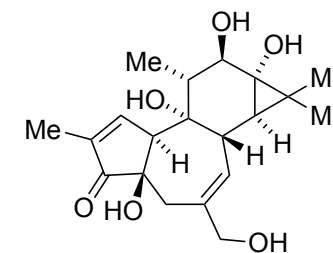
- 7) $Mn(acac)_2$, O_2 , $PhSiH_3$, PPh_3 then TMSOTf
- 8) TFDO then ZnI_2 , MgI_2
- 9) $Mn(acac)_2$, O_2 , $PhSiH_3$, PPh_3
- 10) $RuCl_3$, $NaBrO_3$
- 11) TFAA, DMAP then Zn, AcOH then Ac_2O , DMAP then Et_3N

What is the name of the starting material and how would you classify it?

7) Name and mechanism of the reaction?

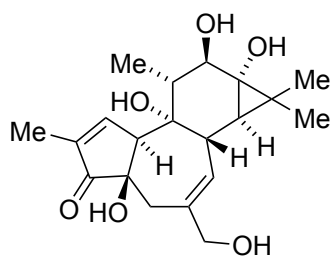
8) Hint: TFDO oxidation of a methylene carbon

11) Hint: multistep reaction - after addition of Ac_2O two new rings have formed - after Et_3N cyclopropane ring formed again



(+)-phorbol

12-19



(+)-phorbol

- 12) TsNHNH_2 then NaBH_3CN
- 13) CrO_3 , 3,5-dimethylpyrazole
- 14) TMSN_3 then I_2 , pyridine
- 15) Me_4Sn , AsPh_3 , $\text{PdCl}_2(\text{PhCN})_2$, CuI
- 16) HF-Py
- 17) Martin sulfurane then SeO_2
- 18) NaBH_4 then Ac_2O , DMAP
- 19) $\text{NaBH}(\text{OAc})_3$ then TBAF then $\text{Ba}(\text{OH})_2$

13) What is the role of 3,5-dimethylpyrazole?

17) Structure of Martin sulfurane? What name reaction is taking place in this step and what is the mechanism?