

## 2019 ORG MECH: Electrophiles and Acids

Quiz #2    25 pts

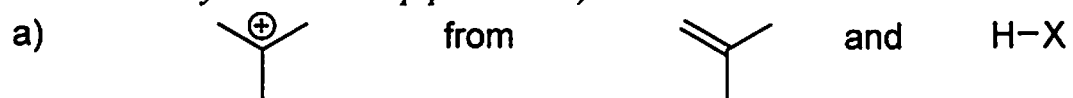
NAME: \_\_\_\_\_

1) Can you prove a mechanism is correct?

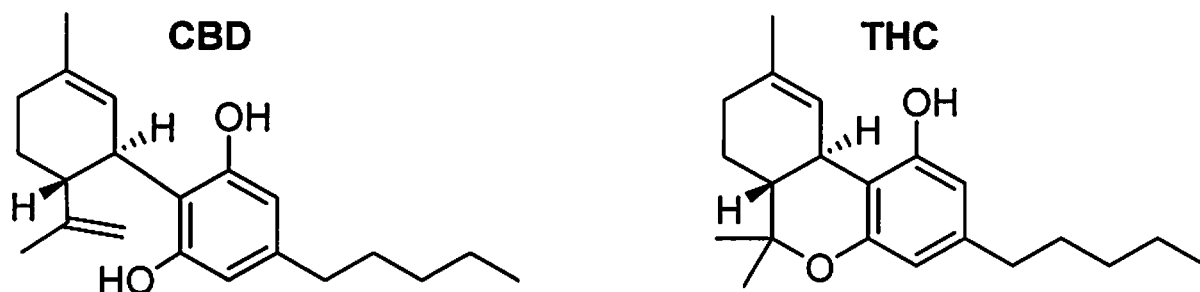
2-5) List the four things that can happen once a Carbocation is generated.

6) What is *Occam's Razor*?

7-10) Carbocations can be generated in many different ways. Using curly arrows, draw mechanisms for the following carbocation formations. (*Note that some may be multi-step processes*).



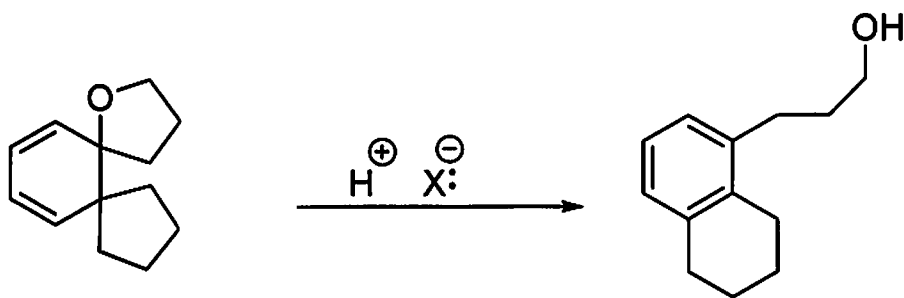
11-15) “Cannabinoid” refers to compounds that act on cannabinoid receptors that alter neurotransmitter release in the brain. Cannabis (Marijuana) contains at least 100 different cannabinoids. The primary psychoactive molecule in cannabis is **THC**, which creates the “high” or “stoned” feeling, whereas recent interest has increased in the molecule **CBD** which has zero psychoactivity (i.e. does not get you “high”), but does have positive effects on anxiety, cognition, inflammation, PTSD and pain relief. The structures of CBD and THC (which are isomers) are shown below:



CBD is converted into THC by an acid catalyzed reaction. Using any acid you wish, write a mechanism that converts CBD into THC.

16) What type of isomers are CBD and THC?

17-25) The following reaction is another acid catalyzed isomerization.



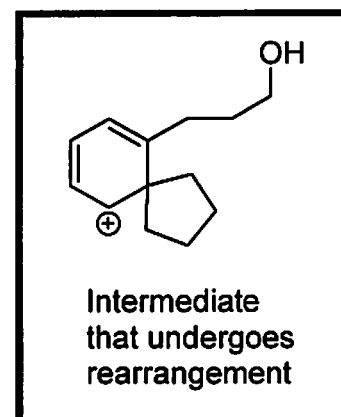
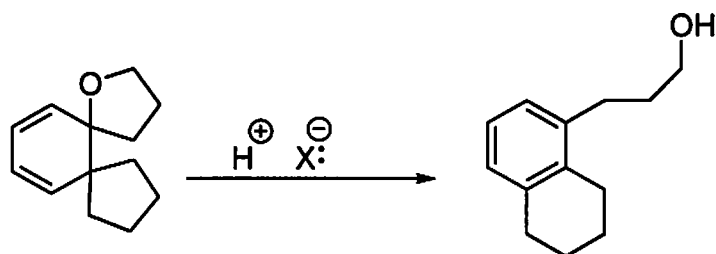
17) What molecular formula (e.g.  $C_xH_yO_z$ ) do the starting material and product have in common?

18) What do you think is the energetic driving force for this reaction to proceed?

19-20) Label the Carbon atoms in your starting material, and indicate where they end up in your product.

21-24) The reaction starts with the protonation of the Oxygen, which then generates a resonance stabilized Carbocation, which then undergoes a Carbocation Rearrangement, and the new Carbocation is ultimately deprotonated to generate the final product.

Using curly arrows, draw a mechanism (including all intermediates) for this reaction.



25) Provide an additional term that describes the Carbocation rearrangement in the previous reaction.

**\*\*Up to 2 Bonus Points\*\***

For the last question (17-25), what are the names of the functional groups involving the Oxygen atom in the starting material, and the product?

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Perfect Answers

1) Can you prove a mechanism is correct?

No. You can only DISPROVE incorrect mechanisms.  
(At best you can say that a mechanism is consistent with all the experimental observations).

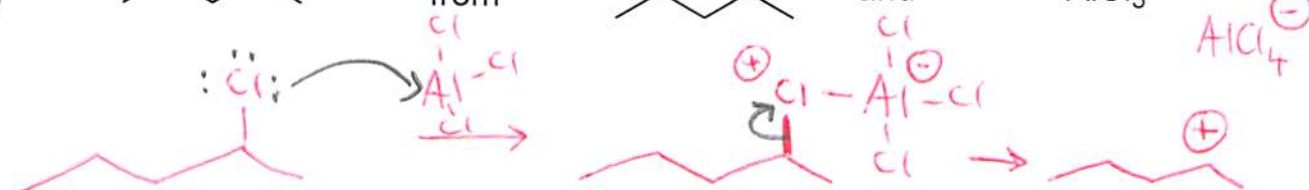
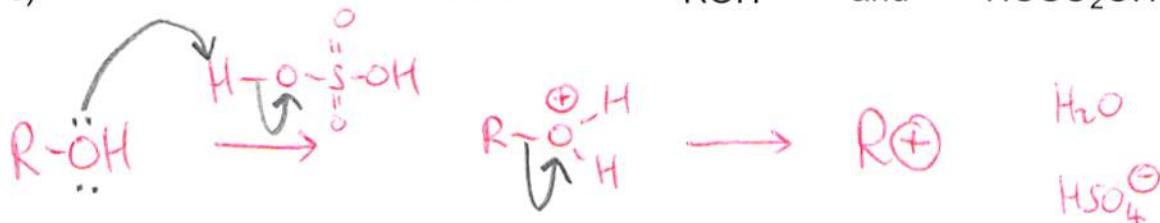
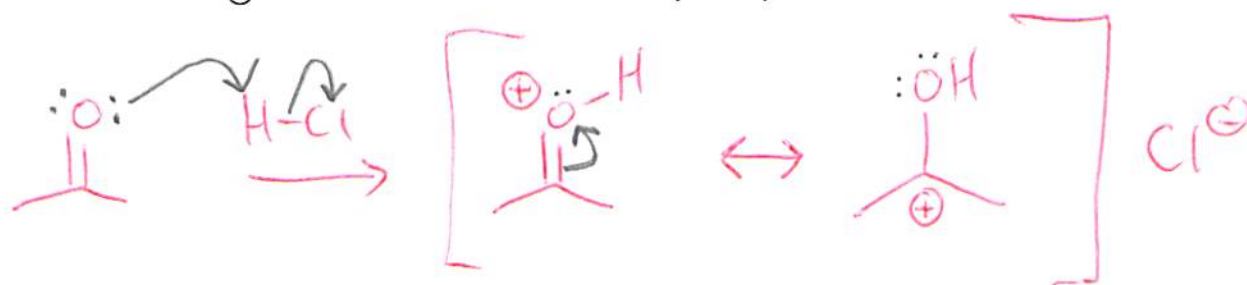
2-5) List the four things that can happen once a Carbocation is generated.

- 1) React with the leaving group ( $\rightarrow$  starting material).
- 2) React with a nucleophile ( $\rightarrow$  SN1 product).
- 3) React with a base ( $\rightarrow$  E1 product).
- 4) Rearrange to a different cation of similar or improved stability.

6) What is Occam's Razor?

(With everything else being equal) the simplest solution is likely the best solution.

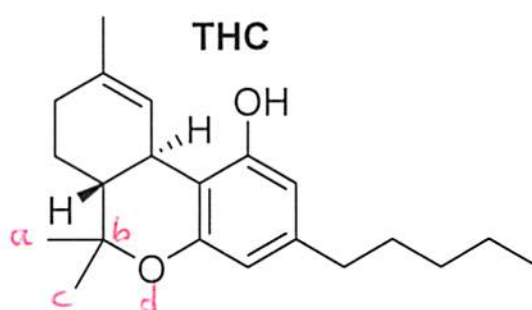
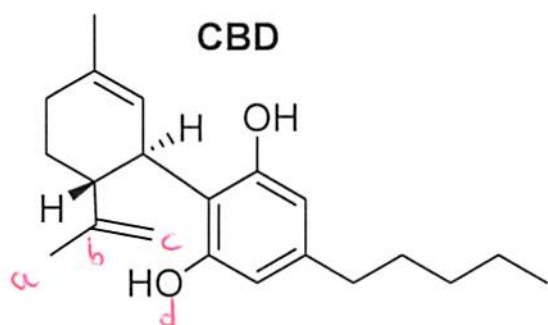
7-10) Carbocations can be generated in many different ways. Using curly arrows, draw mechanisms for the following carbocation formations. (Note that some may be multi-step processes).



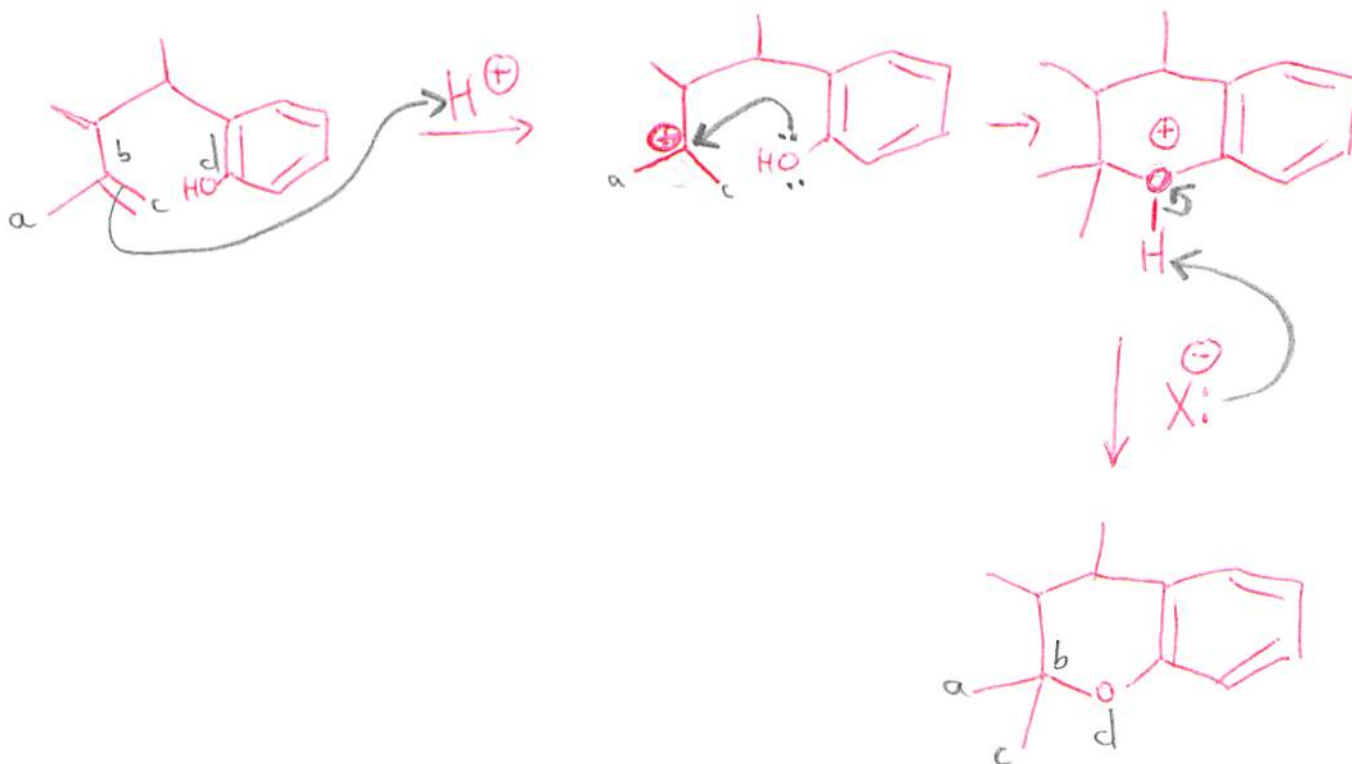
(also acceptable



11-15) “Cannabinoid” refers to compounds that act on cannabinoid receptors that alter neurotransmitter release in the brain. Cannabis (Marijuana) contains at least 100 different cannabinoids. The primary psychoactive molecule in cannabis is **THC**, which creates the “high” or “stoned” feeling, whereas recent interest has increased in the molecule **CBD** which has zero psychoactivity (i.e. does not get you “high”), but does have positive effects on anxiety, cognition, inflammation, PTSD and pain relief. The structures of CBD and THC (which are isomers) are shown below:



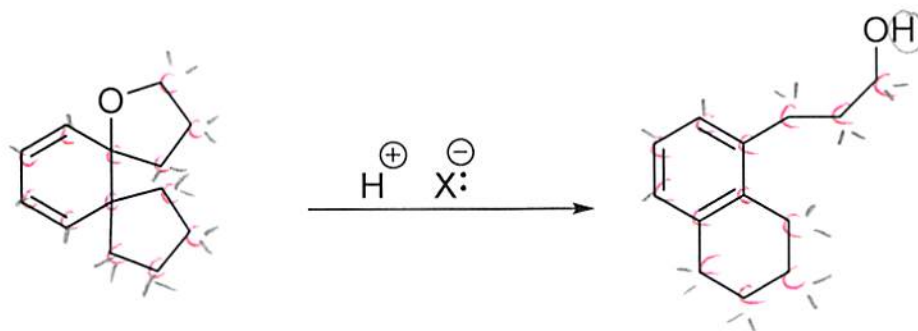
CBD is converted into THC by an acid catalyzed reaction. Using any acid you wish, write a mechanism that converts CBD into THC.



16) What type of isomers are CBD and THC?

*Structural isomers.*

17-25) The following reaction is another acid catalyzed isomerization.



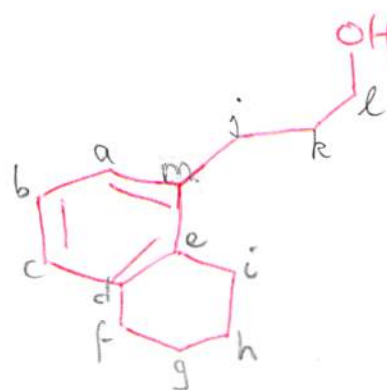
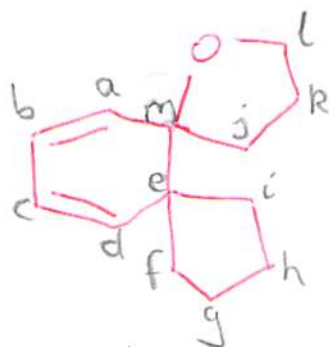
17) What molecular formula (e.g.  $C_xH_yO_z$ ) do the starting material and product have in common?



18) What do you think is the energetic driving force for this reaction to proceed?

formation of a  $6\pi$  aromatic ring.

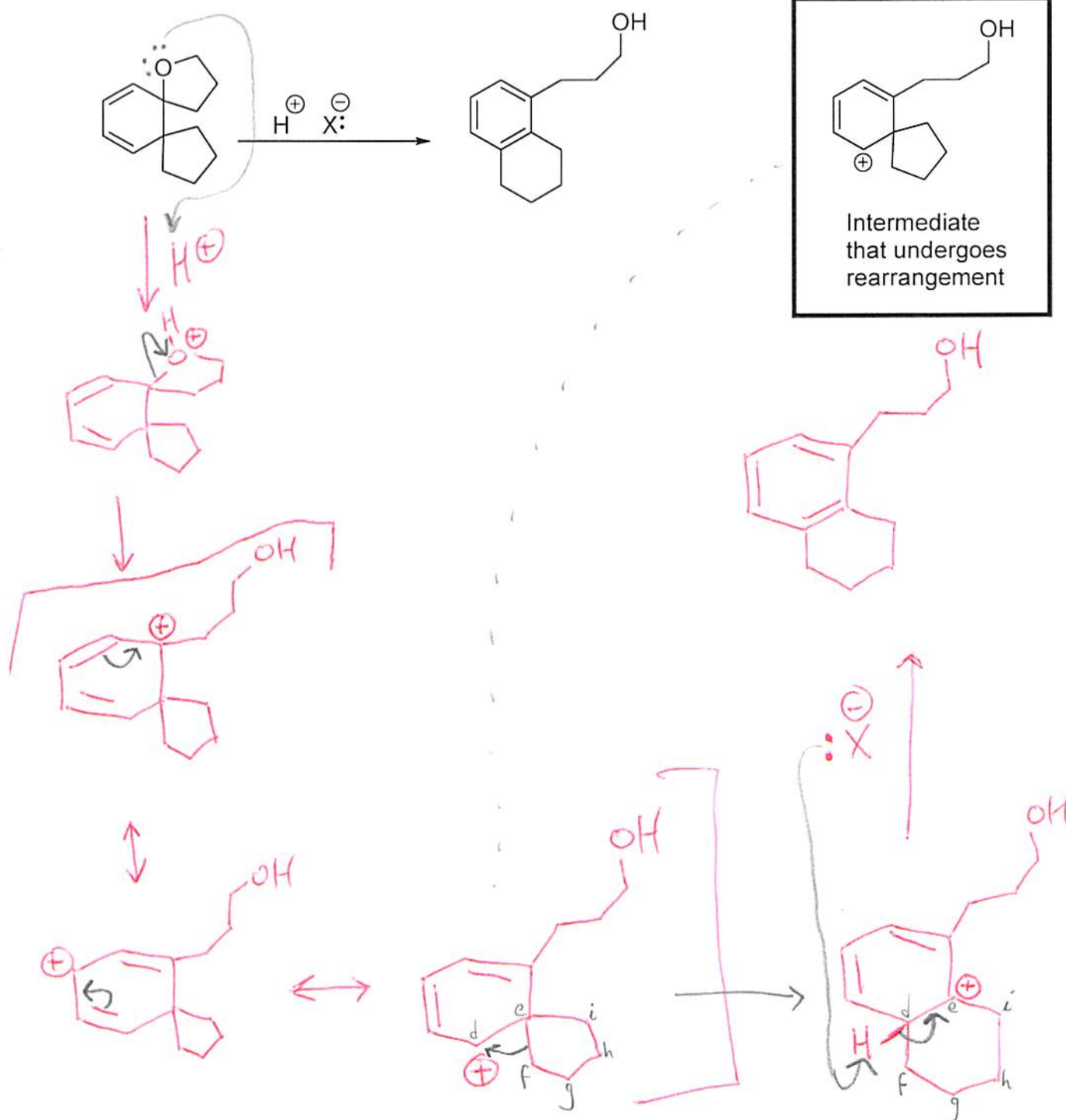
19-20) Label the Carbon atoms in your starting material, and indicate where they end up in your product.



(Technically  
 $i = f$  and  $g = h$ )

21-24) The reaction starts with the protonation of the Oxygen, which then generates a resonance stabilized Carbocation, which then undergoes a Carbocation Rearrangement, and the new Carbocation is ultimately deprotonated to generate the final product.

Using curly arrows, draw a mechanism (including all intermediates) for this reaction.



25) Provide an additional term that describes the Carbocation rearrangement in the previous reaction.

Ring Expansion

1,2 Shift

Alkyl shift

1,2 Migration

Alkyl Migration,

**\*\*Up to 2 Bonus Points\*\***

For the last question (17-25), what are the names of the functional groups involving the Oxygen atom in the starting material, and the product?

Ether  $\rightarrow$  (primary) alcohol.