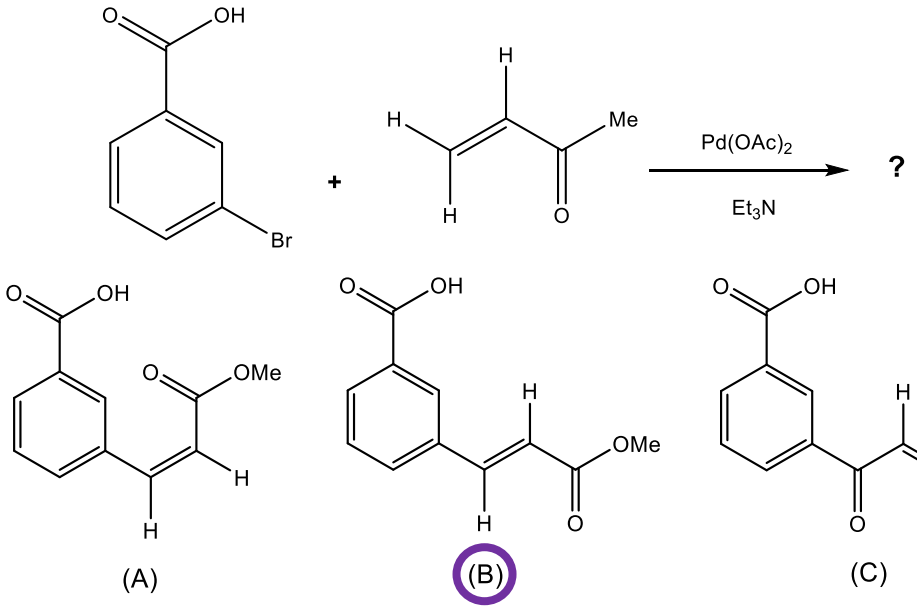
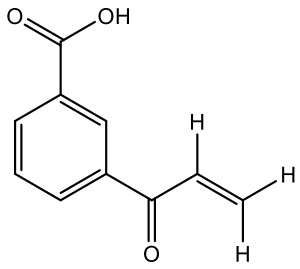
1. Choose the major thermodynamic product of the following reaction.

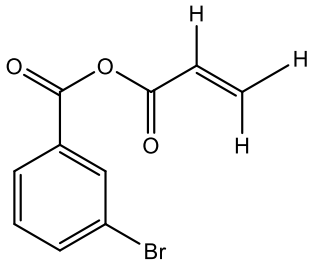


(A)

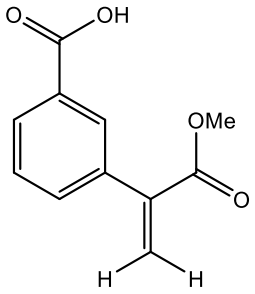
(B)



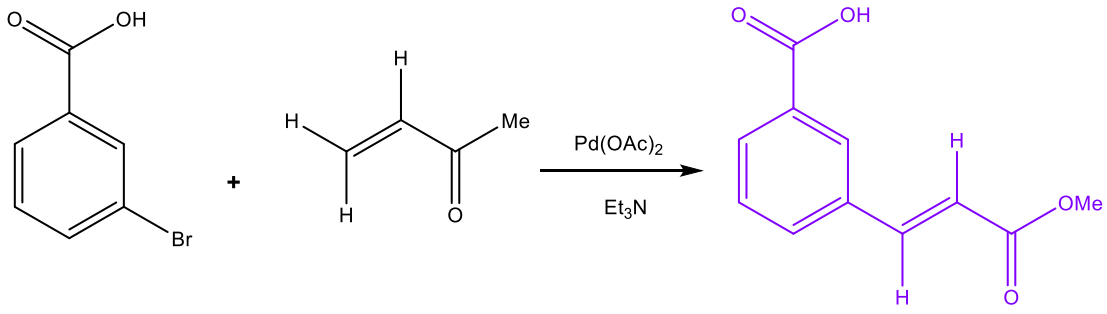
(C)



(D)

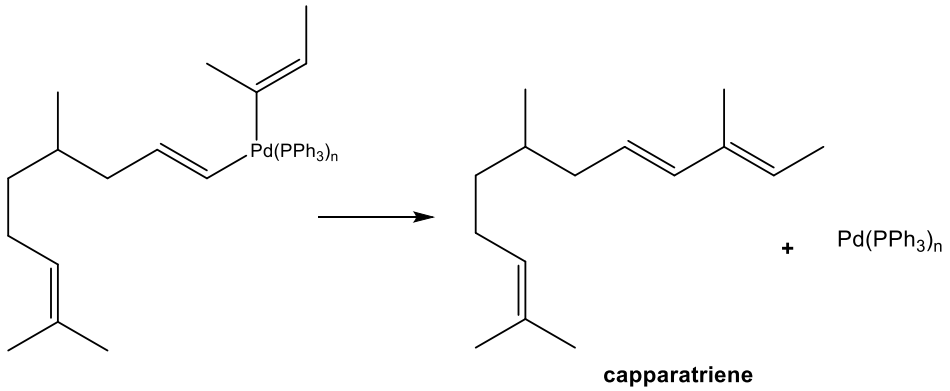


(E)



(B)

2. Choose the correct description of the last step of the Suzuki Reaction.



capparatriene

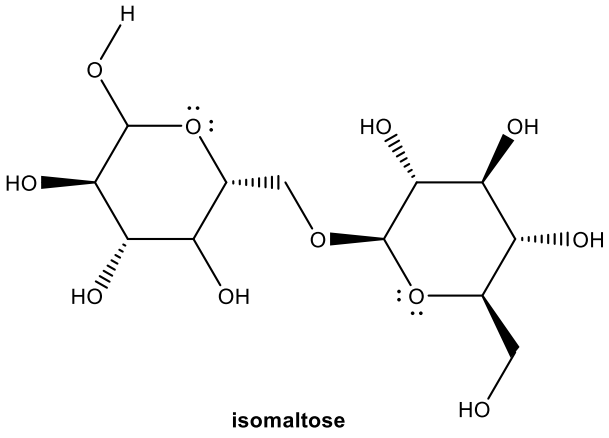
(A) Oxidative addition (C) Ligand deinsertion (E) Ligand disassociation

(B) Reductive elimination (D) Ligand Insertion

3. In the above reaction choose the value of n in the reactant if the Palladium has 16 electrons in its valence shell.

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

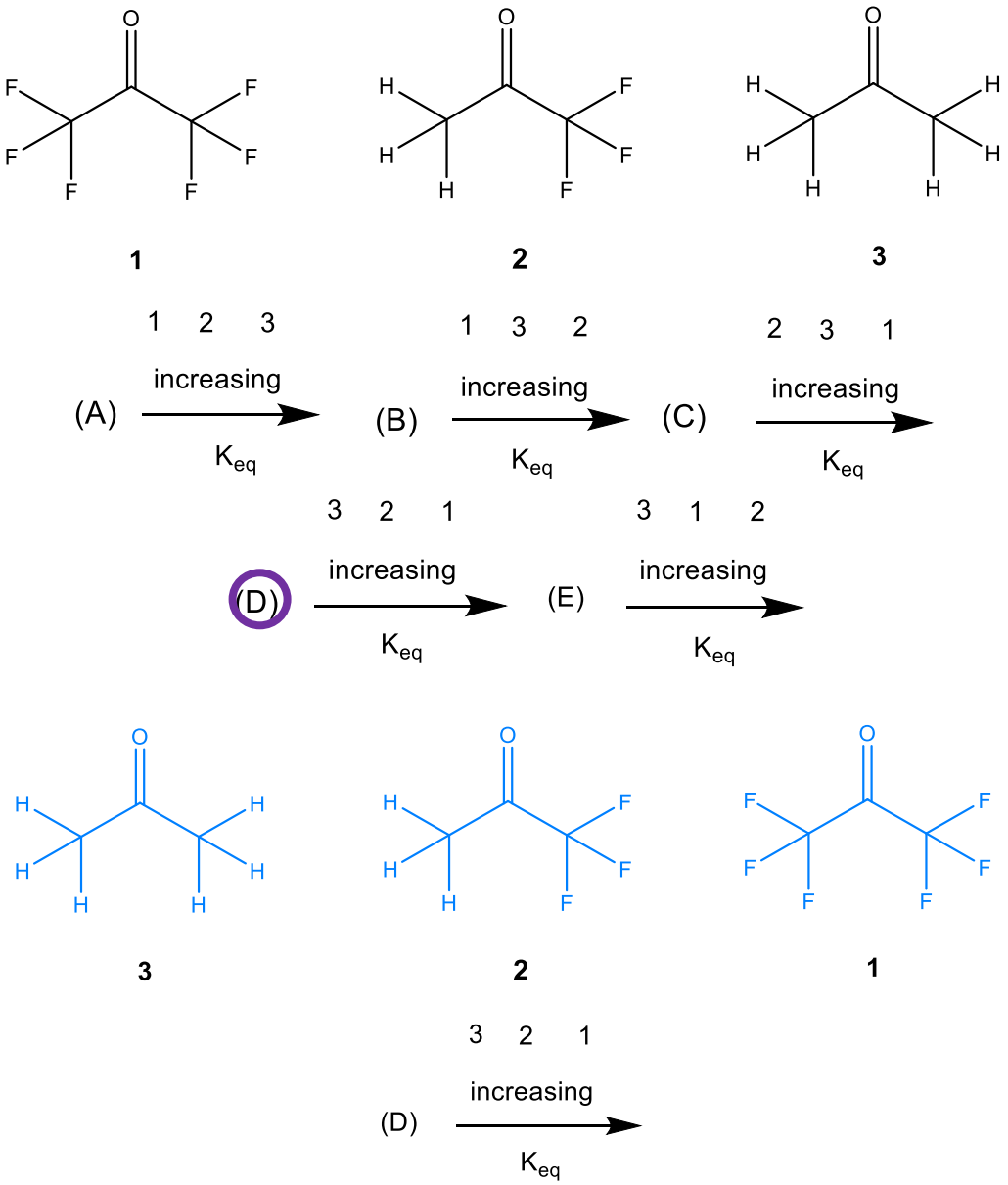
4. Choose the answer that has correctly identified the number of acetals and hemiacetals in isomaltose.



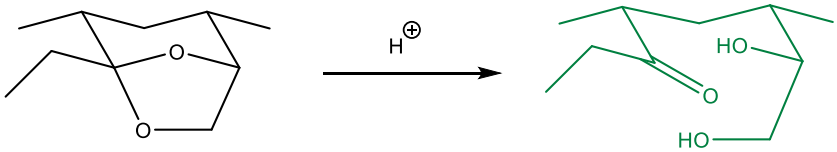
isomaltose

	Acetal	**Hemiacetal**
(A)	0	0
(B)	1	0
(C)	0	1
(D)	1	1
(E)	1	2

5. Choose the order that has the following carbonyl groups correctly arranged with respect to increasing K_{eq} of their hydration reaction.



6. Predict the major products of the following reaction.

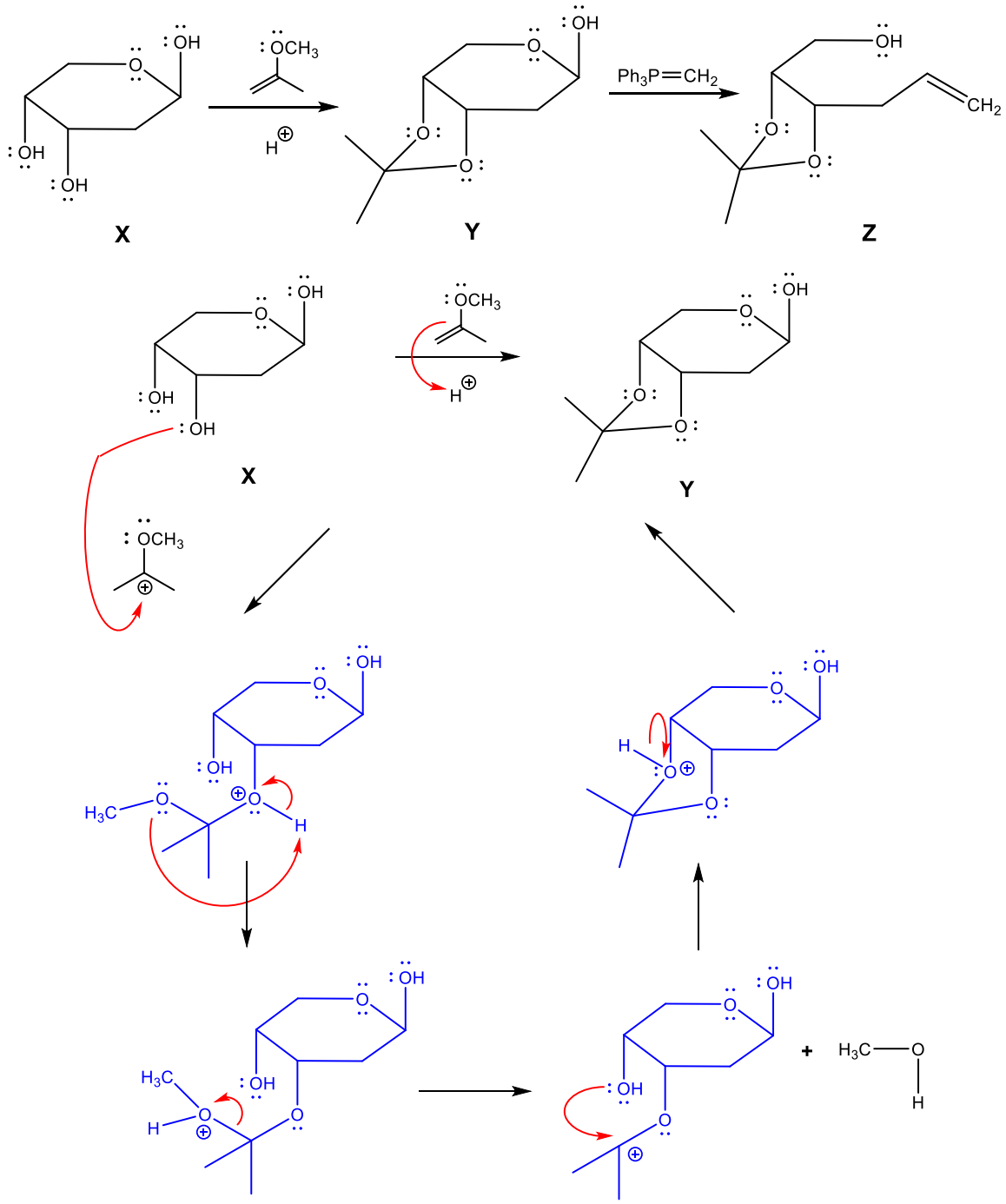


Multistriaitin

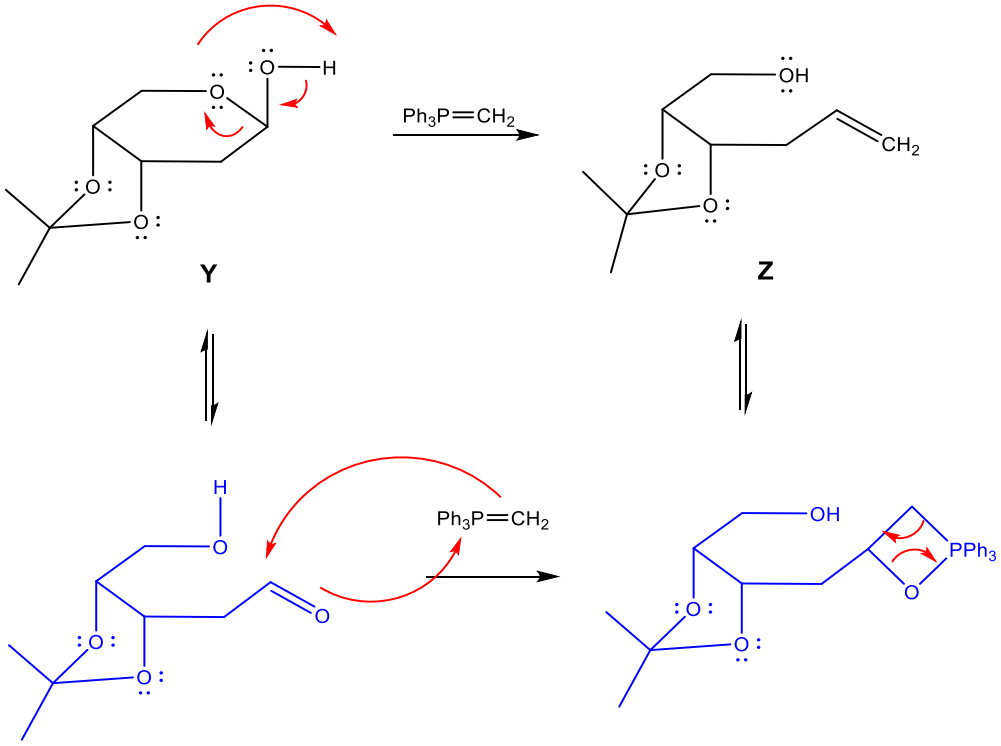
$C_{10}H_{18}O_2$

$C_{10}H_{20}O_3$

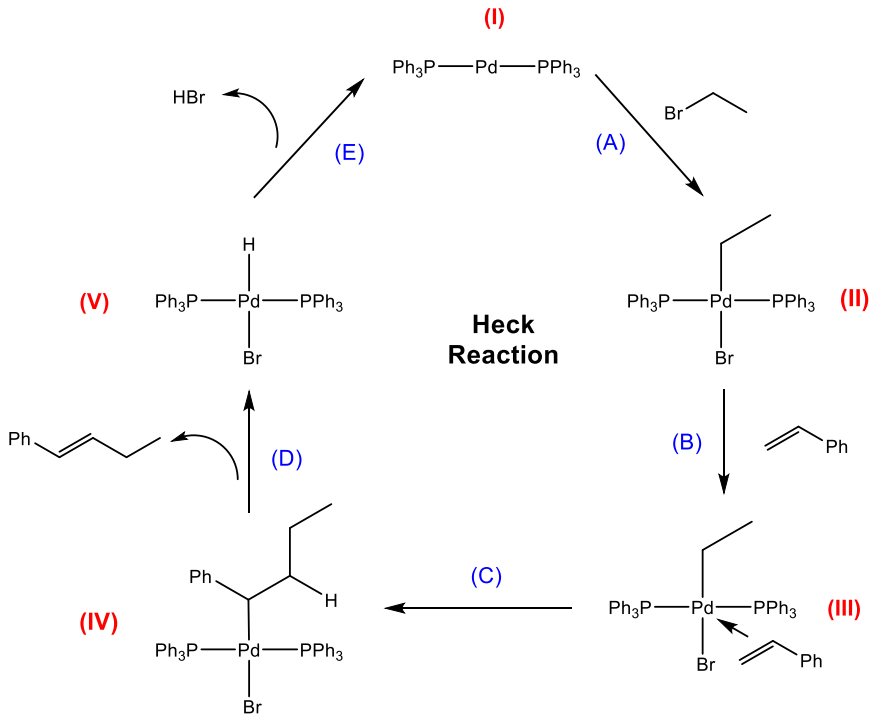
7. Using the curved arrow formalism show the bond breaking and bond making that occurs in the transformation of **X** to **Y** in the following reaction.



8. Using the curved arrow formalism show the bond breaking and bond making that occurs in the transformation of **Y** to **Z** in the above reaction.



9.The mechanism of the Heck reaction is shown below. Use the diagram to answer the next four questions.



i. Which of the five labeled steps of the mechanism is an oxidative addition reaction?

(A) (B) (C) (D) (E)

ii. Which of the five labeled steps of the mechanism is a ligand insertions reaction?

(A) (B) (C) (D) (E)

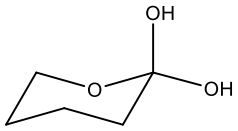
iii. What is the electron count for palladium compound **(III)**?

(A) 14 (B) 15 (C) 16 (D) 17 (E) 18

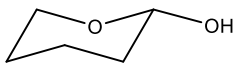
iv. What is the electron count for Palladium compound **(IV)**?

(A) 14 (B) 15 (C) 16 (D) 17 (E) 18

Consider the following structures

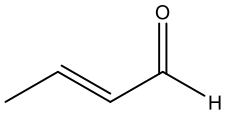


(A)

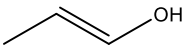


(B)

(C)



(D)

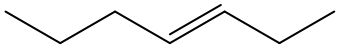


(E)

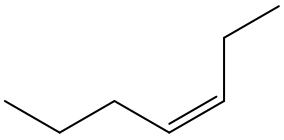
10. Which structure is an acetal? **(C)**

11. Which structure is an enol? **(E)**

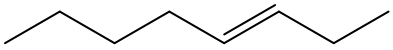
Consider the following alkenes



(A)

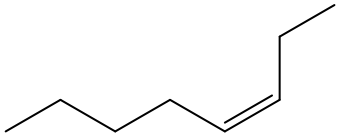


(B)



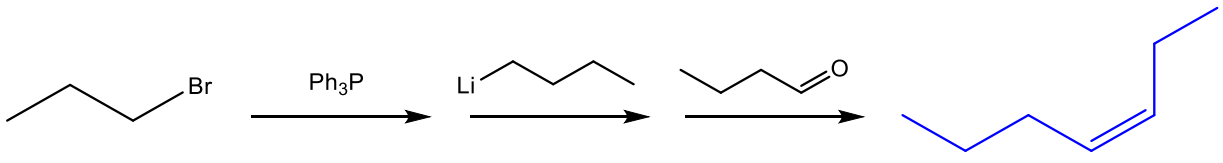
(C)

(D)



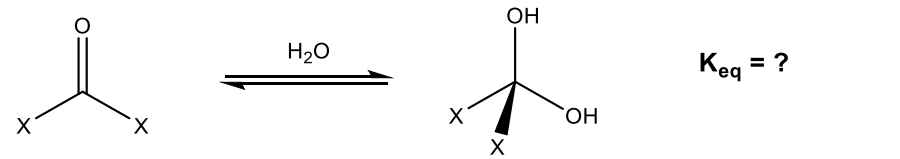
(E)

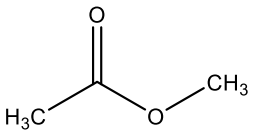
12. Predict the major product of the following reaction sequence.



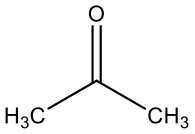
(B)

13.Carbonyl compounds can form a hydrate as shown in the following equilibrium equation. Whi ch of the compounds would be predicted to have the highest equilibrium constant for hydrate for mation?

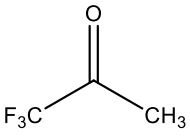




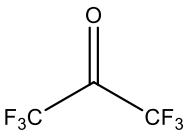
(A)



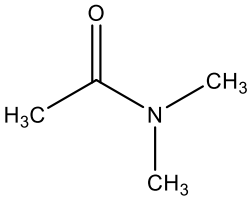
(B)



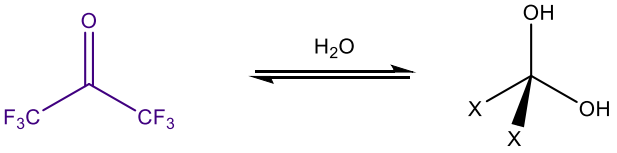
(C)



(D)

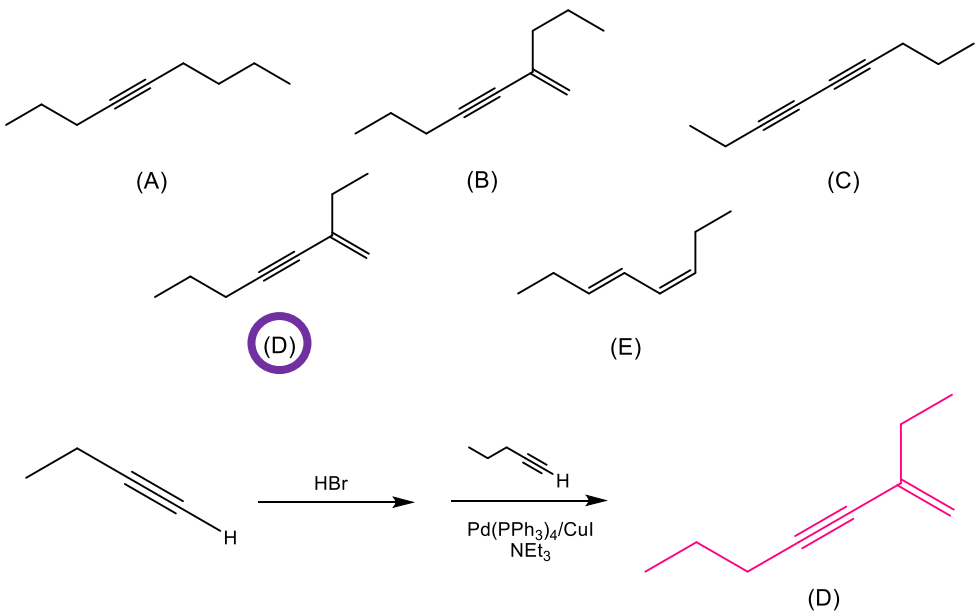


(E)

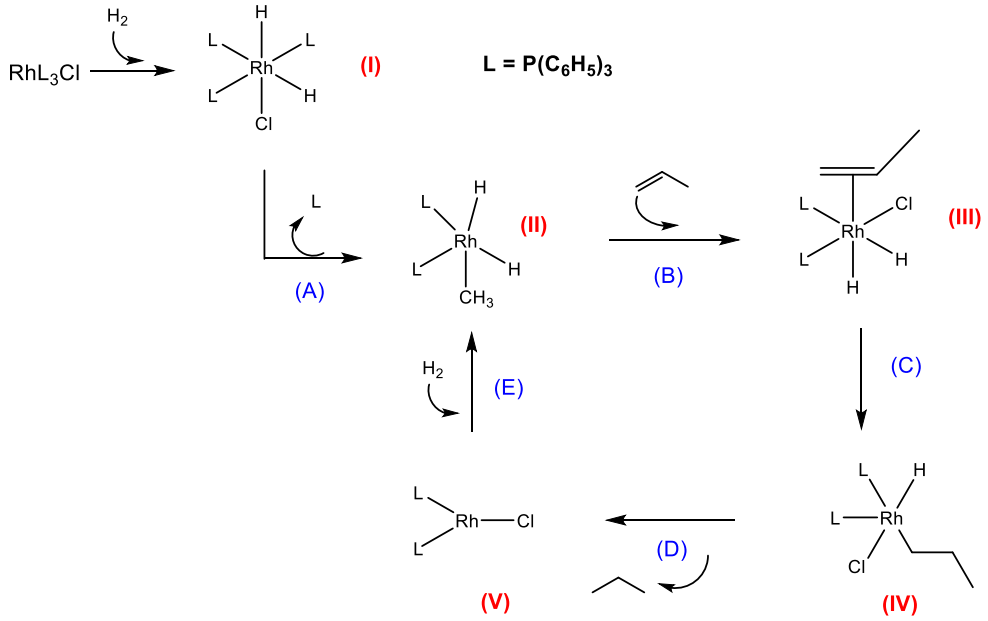


(D)

14. Predict the major product of the following reaction sequence.



15. The following scheme illustrates a catalytic cycle for the hydrogenation of propene using a rhodium catalyst, $Rh[P(C_6H_5)_3]_3Cl$. The next three questions refer to this scheme.



i. Which of the labeled steps in the above catalytic cycle is an oxidative addition reaction?

(A) (B) (C) (D) (E)

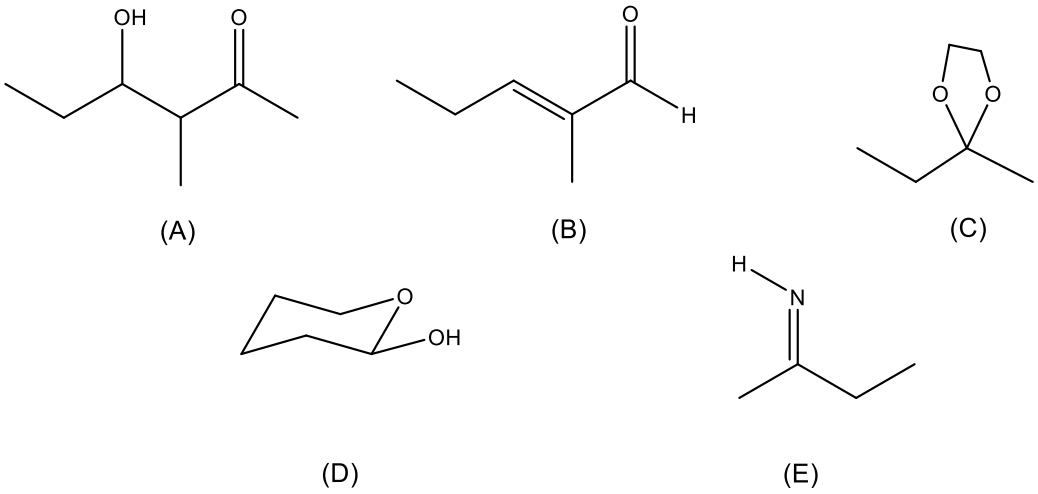
ii. Which of the labeled steps in the above catalytic cycle is a reductive elimination reaction?

(A) (B) (C) (D) (E)

iii. Which of the rhodium complexes is a 14 electron complex?

(A) (I) (B) (II) (C) (III) (D) (IV) (E) (V)

Consider the following molecules.



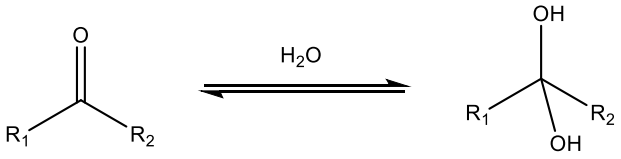
(A) (B) (C)

(D) (E)

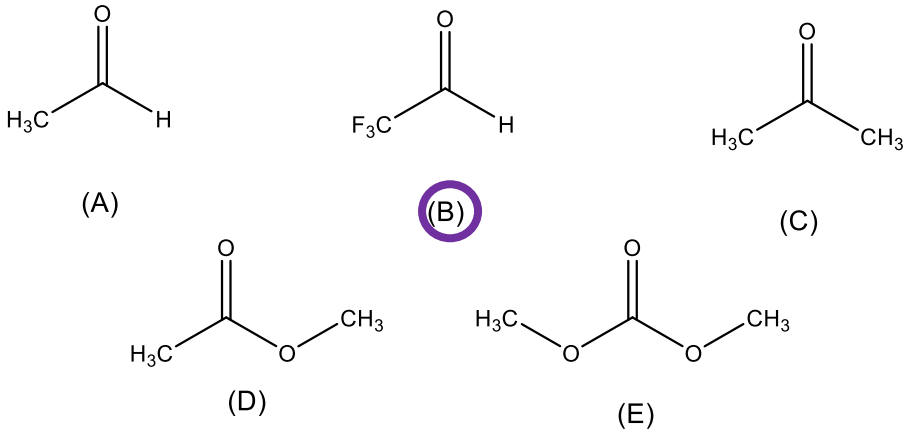
16. Which of the above molecules is an enal? **(B)**

17. Which of the above molecules is a hemiacetal? **(D)**

18. Carbonyl compounds can react with water to form a diol.

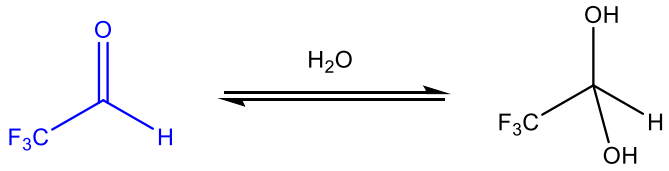


Which of the following compounds would be anticipated to have the largest equilibrium constant, Keq, for this hydration reaction?



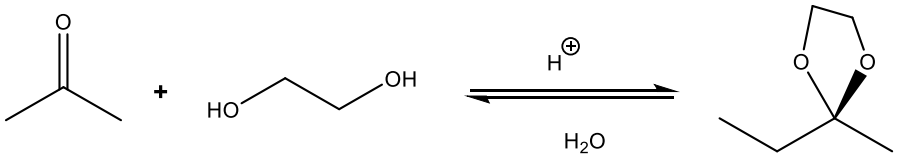
(A) (B) (C)

(D) (E)

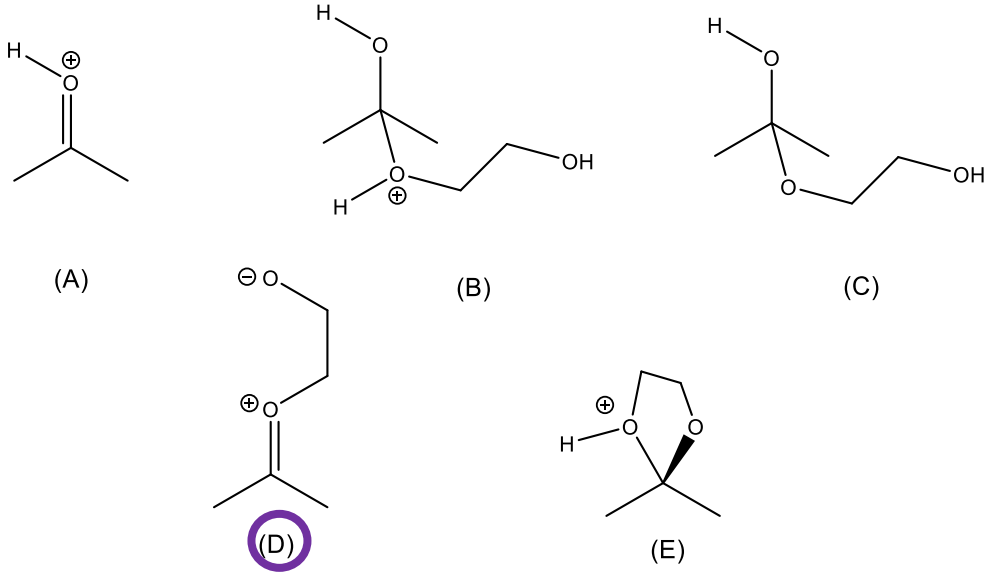


(B)

19. A student was asked to write a mechanism for the following reaction.



Which of the following intermediates would be the least likely to be found in a correct mechanism?

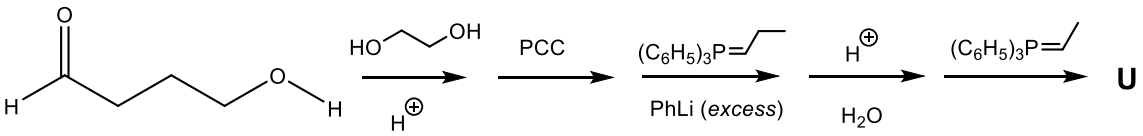


(A) (B) (C)

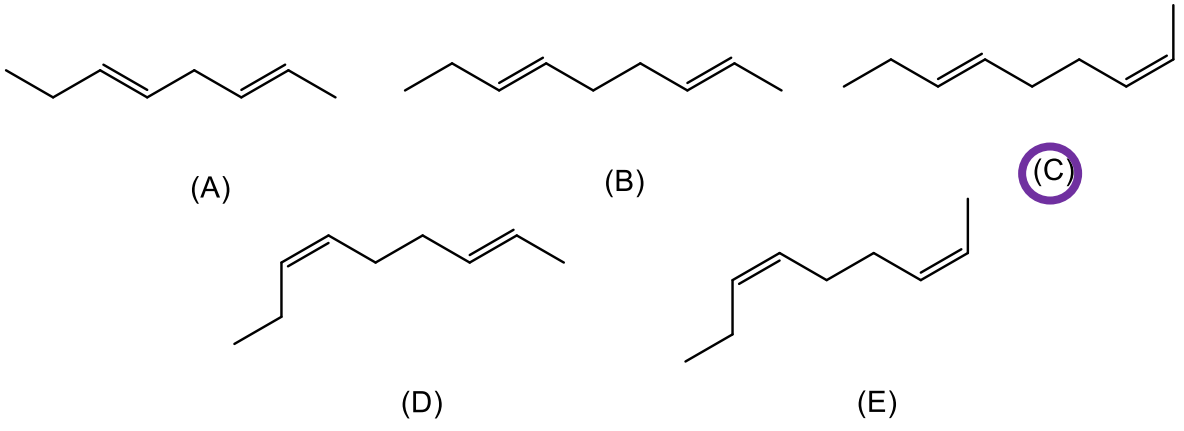
(D)

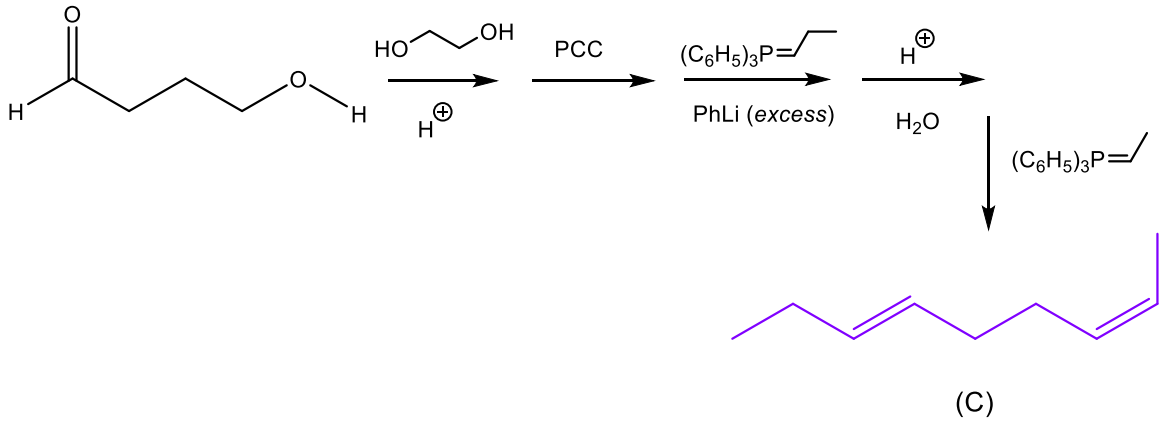
(E)

20. The following reaction sequence yields compound U.



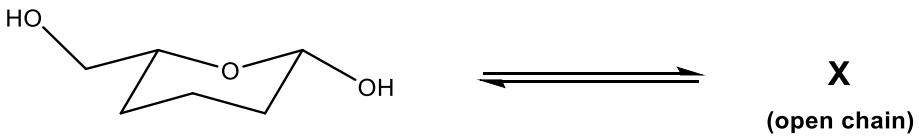
Predict the structure of U.



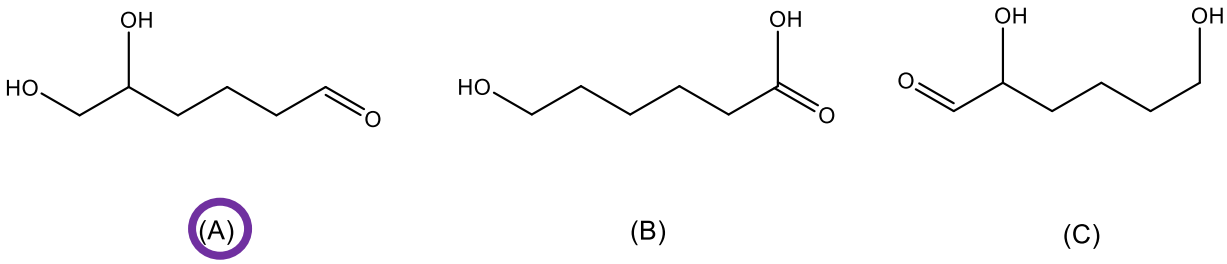


(C)

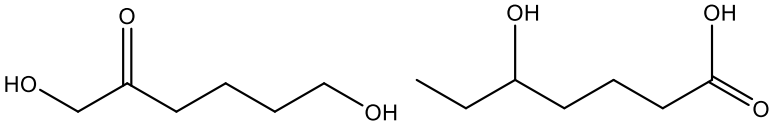
21. The compound shown below is a cyclic hemiacetal. It is in equilibrium with an acyclic open chain compound X.



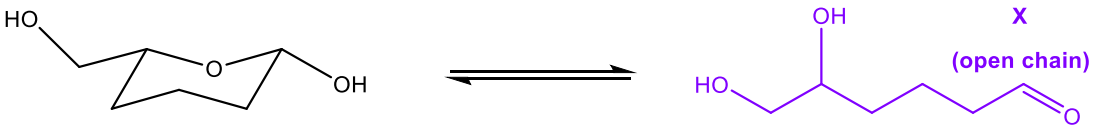
Identify the structure of compound X.



(A) (B) (C)

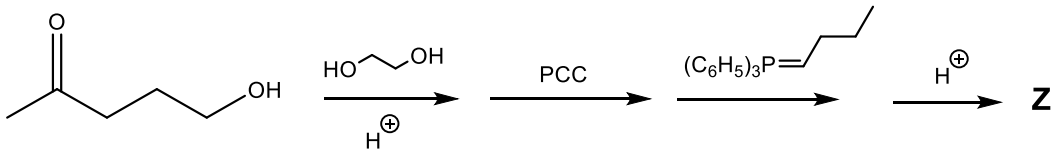


(D) (E)

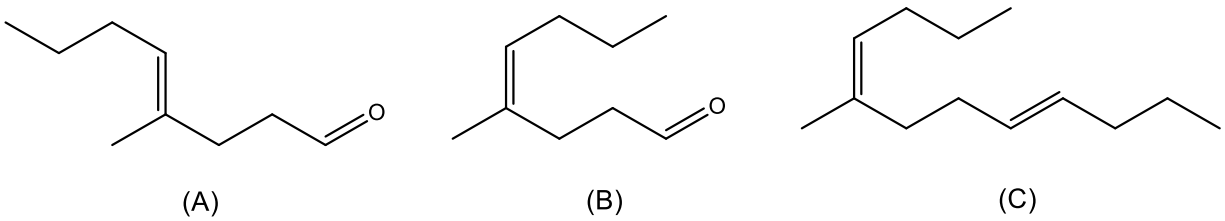


(A)

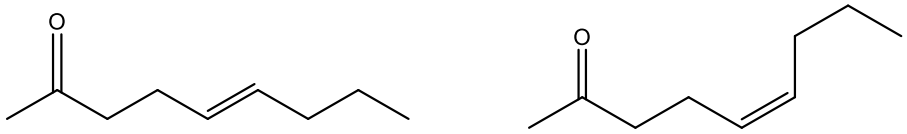
22. The reaction sequence shown below gives compound Z as the main product.



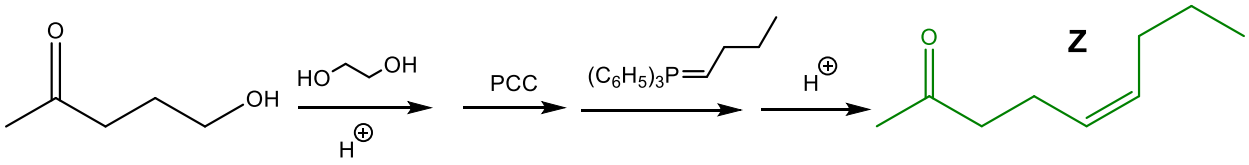
Identify the structure of compound Z.



(A) (B) (C)

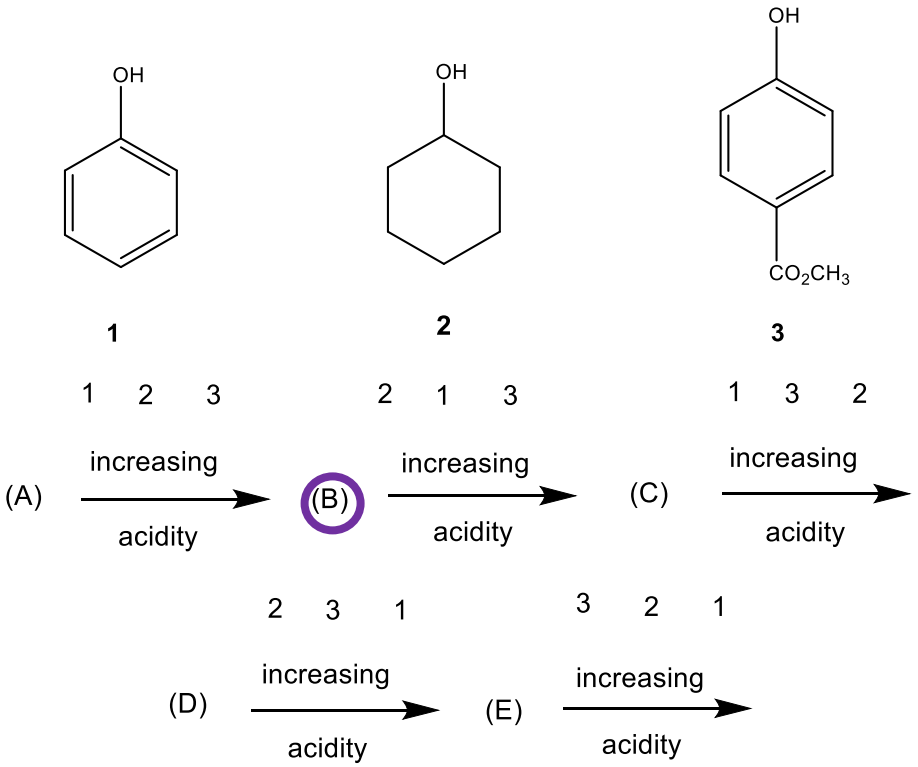


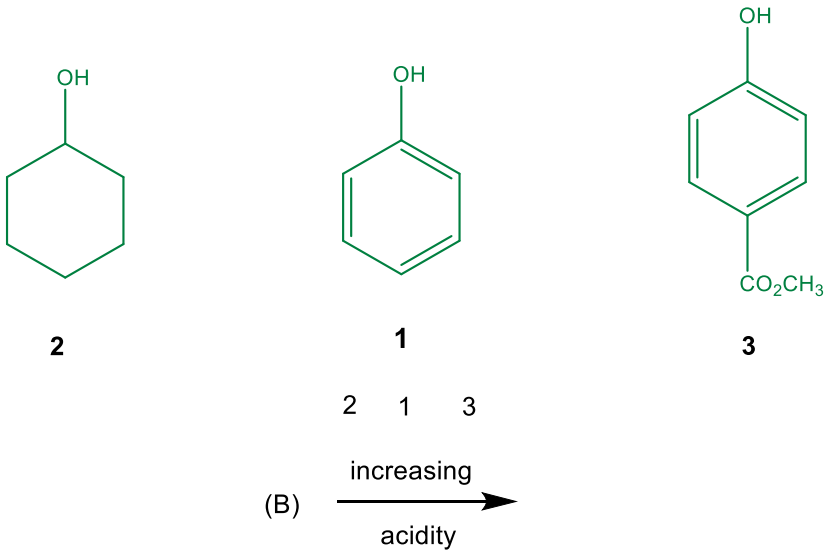
(D) (E)



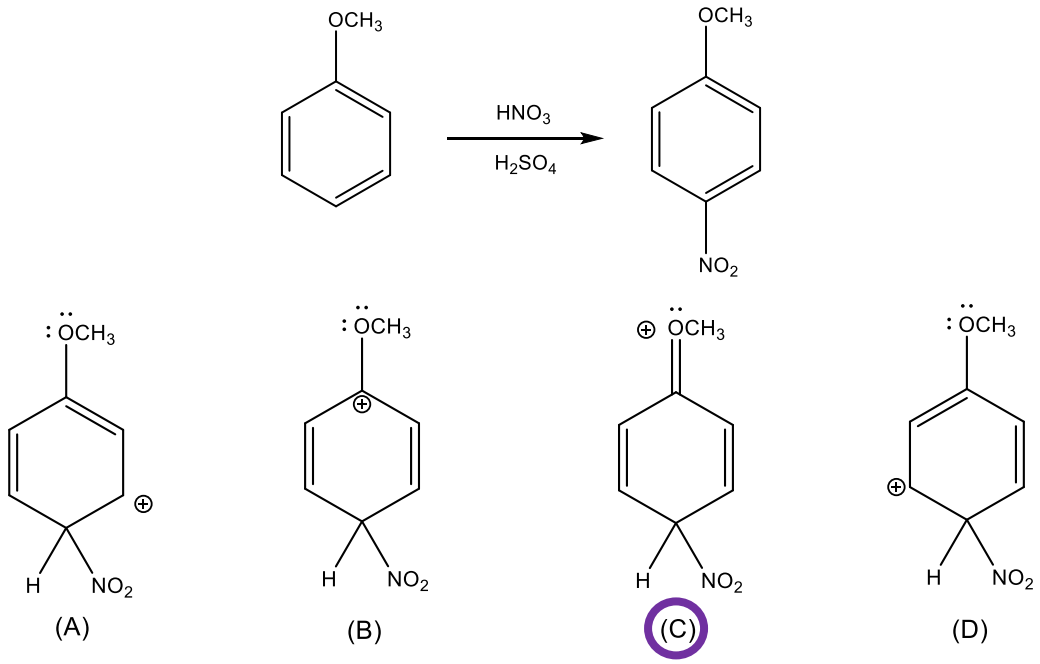
(E)

23. Choose the order that has the following alcohols correctly arranged with respect to increasing acidity.





24. Choose the resonance structure that best represents the intermediate in the nitration of anisole.



25. Predict the major product of the following reaction sequence.