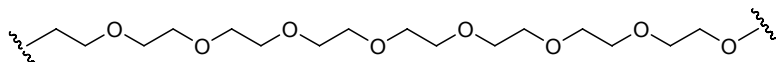


Multiple Choice Questions. 105 points

1. Choose the monomer that could be used to prepare the following chain growth (addition) polymer by anionic polymerization (HO^\ominus).

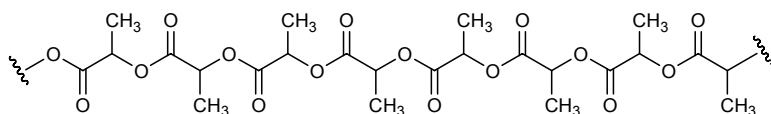
A



- (A) (B) $\text{H}_2\text{C}=\text{C}=\text{O}$ (C) (D) (E)

2. Choose the monomers that could be used to prepare the following step growth polymer.

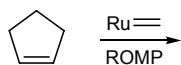
E



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

3. Choose the structure of the polymer produced by the ring opening metathesis reaction (ROMP) using a ruthenium carbene complex.

E



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

4. Choose D-aldohexoses that give the same D-aldopentose when subjected to the Ruff degradation (removal of C1 along with the conversion of C2 to the aldehyde). See the cover for the D-aldopentoses.

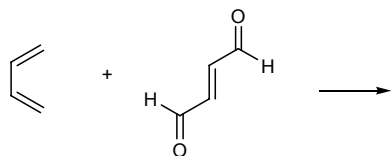
A

- (A) D-glucose and D-mannose (C) D-gulose and D-galactose (E) D-glucose and D-gulose
 (B) D-allose and D-glucose (D) D-mannose and D-talose

Source

9. Choose the *incorrect* statement about the following Diels-Alder reaction.

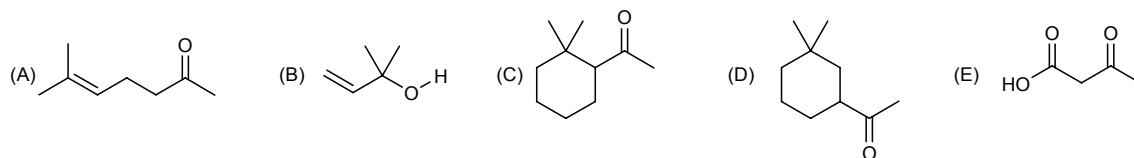
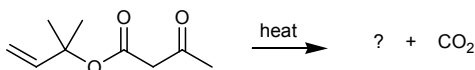
D



- (A) The products of this reaction are chiral.
- (B) The reaction mixture does not rotate the plane of polarized light.
- (C) The dienophile would react faster with 1-methoxybutadiene ().
- (D) The diene would react faster with ethylene ($\text{H}_2\text{C}=\text{CH}_2$).
- (E) The product is a cyclohexene derivative.

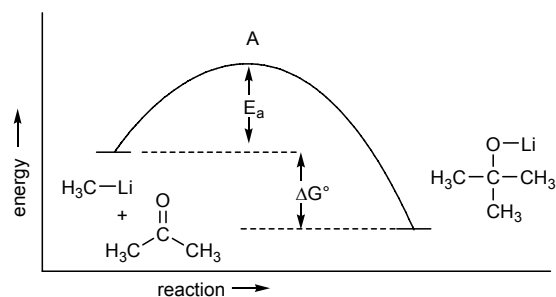
10. Choose the other major product of the following reaction.

A



11. Choose the statement that is most *incorrect* about the following energy profile for the reaction of methyl lithium with acetone.

C

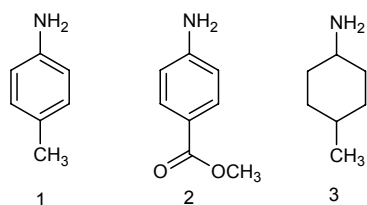


- (A) The rate of the reaction can be evaluated from E_a .
- (B) The equilibrium constant can be evaluated from ΔG° .
- (C) If a condition is changed to decrease the value of E_a is smaller the reaction will proceed at a slower rate.
- (D) The reactants are less stable than the product.
- (E) The transition state for this reaction is at point **A**.

Source

12. Choose the order that has the following compounds correctly arranged with respect to increasing basicity (the most basic is on the right).

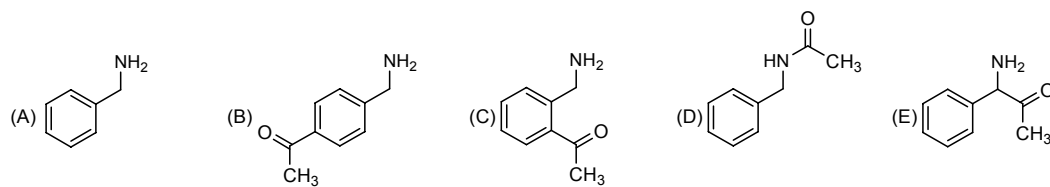
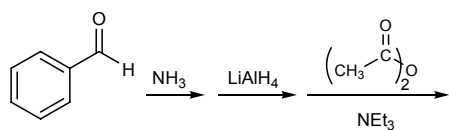
C



- (A) $1 < 2 < 3$ (B) $1 < 3 < 2$ (C) $2 < 1 < 3$ (D) $2 < 3 < 1$ (E) $3 < 2 < 1$

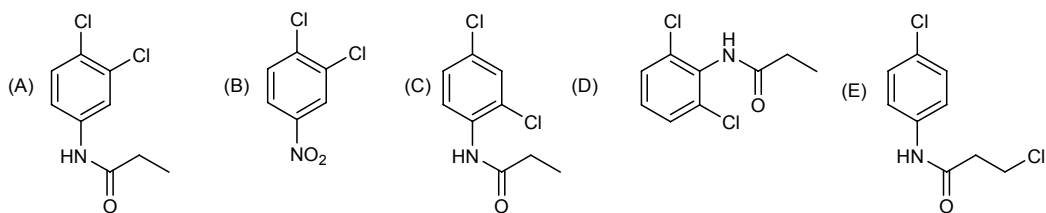
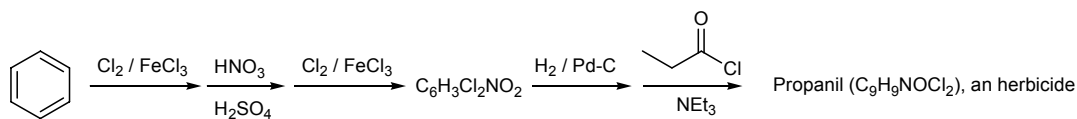
13. Choose the correct structure for the compound produced by the following reaction sequence.

D



14. Choose the correct structure for the compound produced by the following reaction sequence.

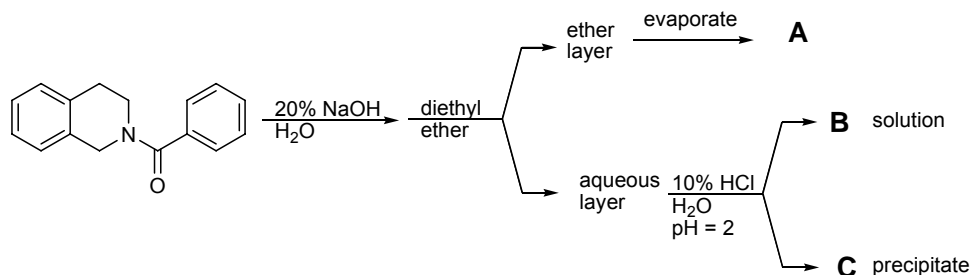
A



Source

15. Choose the true statement about **A**, **B** and **C**.

D



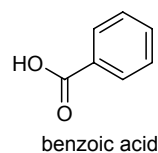
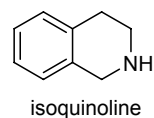
(a) **A** = benzoic acid, **B** = isoquinoline and **C** = sodium chloride.

(b) **A** = benzoic acid, **B** = sodium chloride and **C** = isoquinoline.

(c) **A** = isoquinoline, **B** = benzoic acid and **C** = sodium chloride.

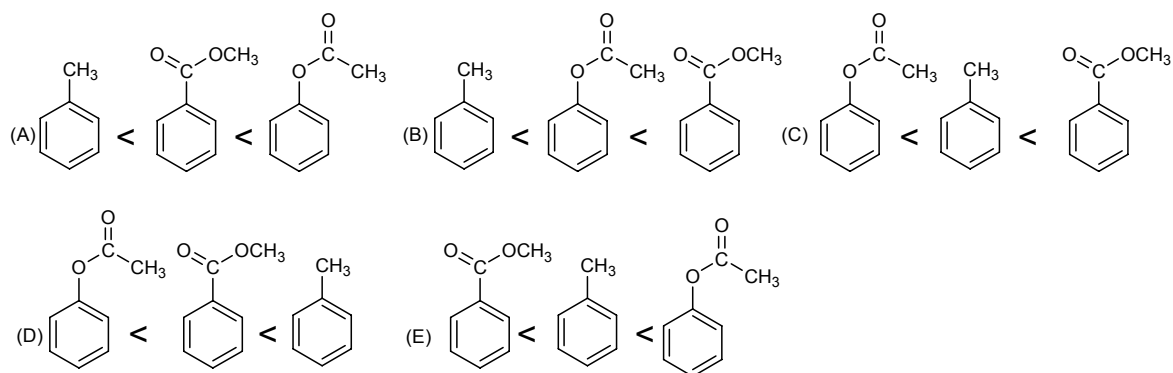
(d) **A** = isoquinoline, **B** = sodium chloride and **C** = benzoic acid.

(e) **A** = sodium chloride, **B** = isoquinoline and **C** = benzoic acid.



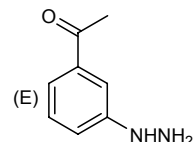
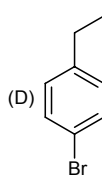
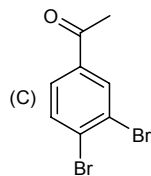
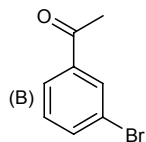
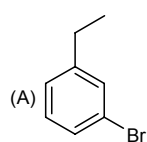
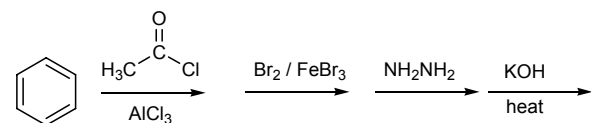
16. Choose the order that has the following compounds ranked correctly with respect to increasing reactivity with $\text{Br}_2/\text{FeBr}_3$. (most reactive on the right)

E



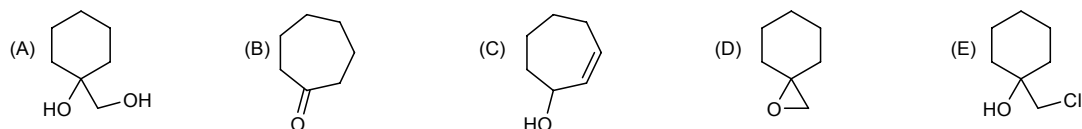
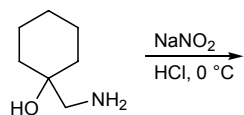
17. Choose the correct structure for the major compound produced by the following reaction sequence.

A

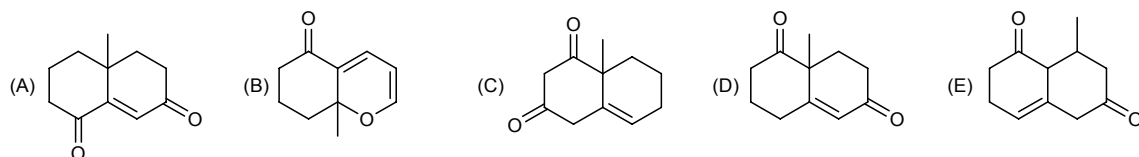
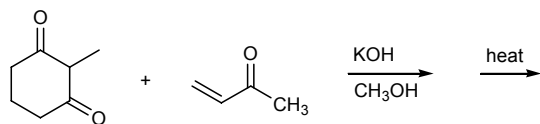


Source

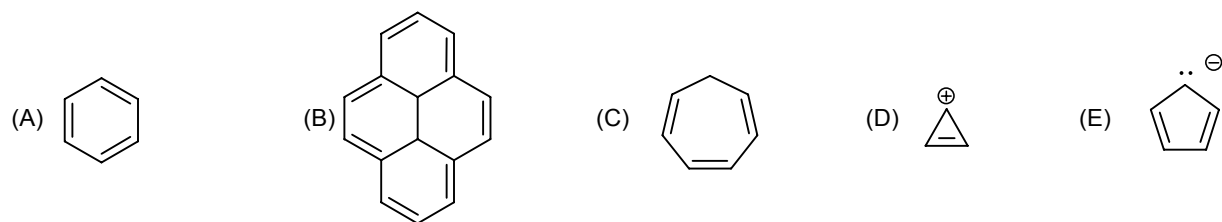
18. Choose the correct structure for the major compound produced by the following reaction sequence. B



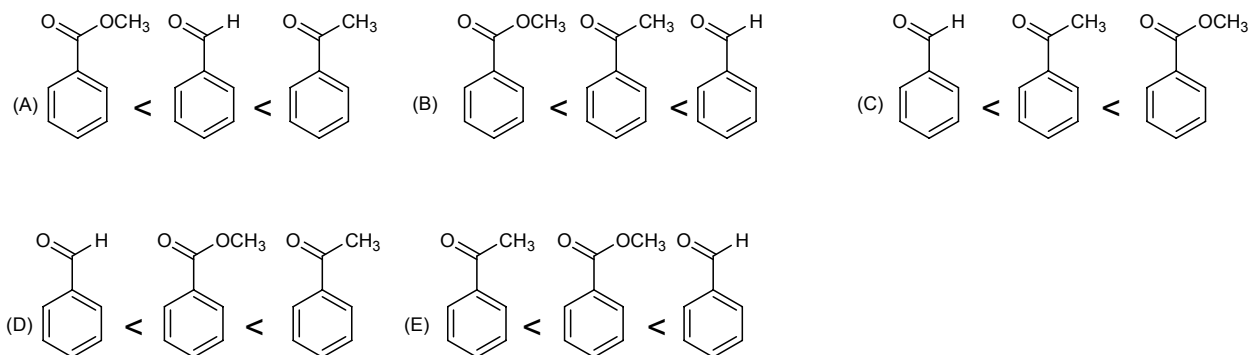
19. Choose the structure for the major compound produced in the following reaction sequence. D



20. Choose the structure predicted *not* to be aromatic. C



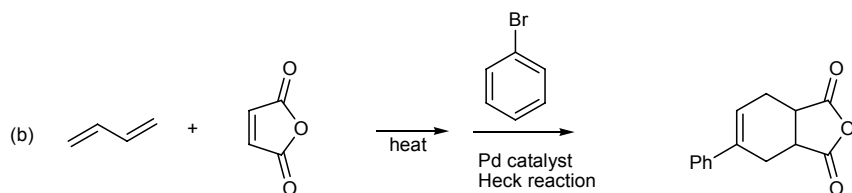
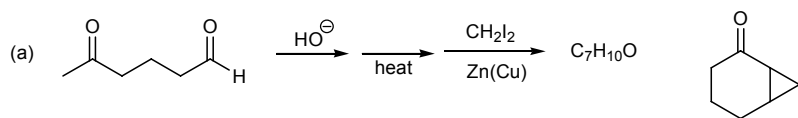
21. Choose the order that has the following compounds correctly arranged with respect to increasing reactivity with NaBH_4 . B



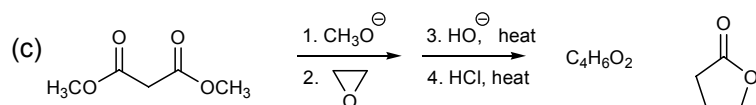
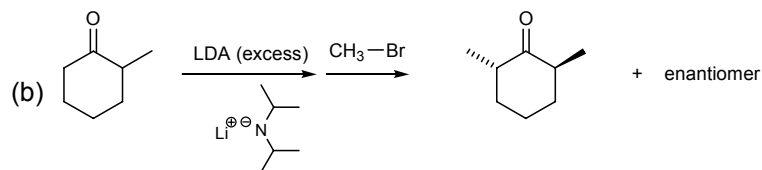
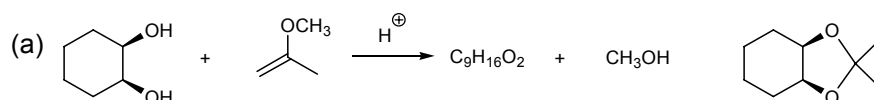
Source

Short Answer Questions. 75 points.

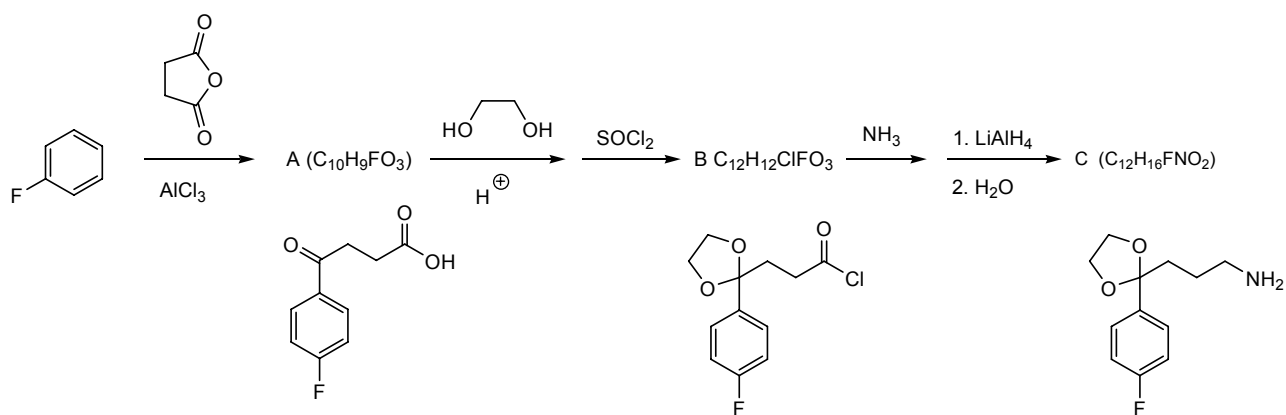
22. Give the structure of the major compound produced in the following reaction sequences. 10 pts



23. Using your understanding of mechanistic chemistry predict the products of the following reactions. 10 pts

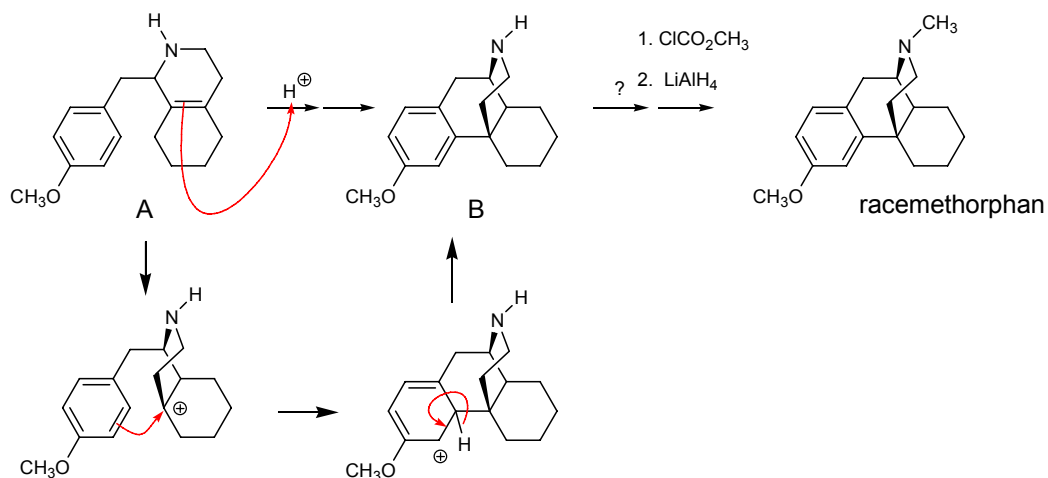


24. The synthesis of haloperidol, an important drug for the treatment of schizophrenia, was discussed in the section on medicinal chemistry. A key intermediate was prepared by a reaction scheme analogous to that shown below. Propose structures for compounds A, B, and C in this reaction scheme. 10 pts



Source

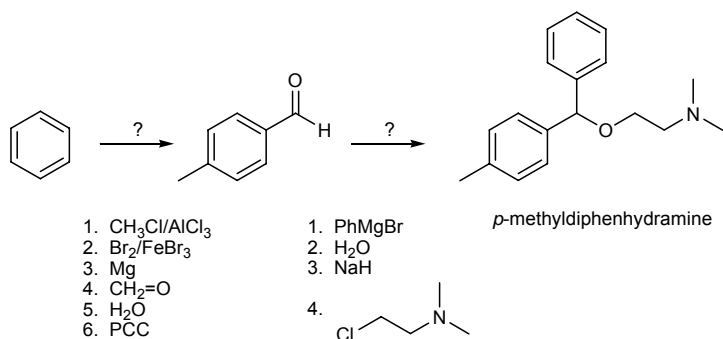
25. Racemorphan is a potent analgesic related to morphine. It has been prepared using the following cyclization reaction of A to B as a key step.



- Using the curved arrow formalism show the bond making and bond breaking that occurs in the transformation of A to B. 10 pts
- Propose reactants and reagents for converting the B into racemorphan. 5 pts
- Would the two enantiomers of racemorphan be predicted to have the *same* or *different* biological activity. 5 pts **The two enantiomers would be predicted to have different biological properties.**

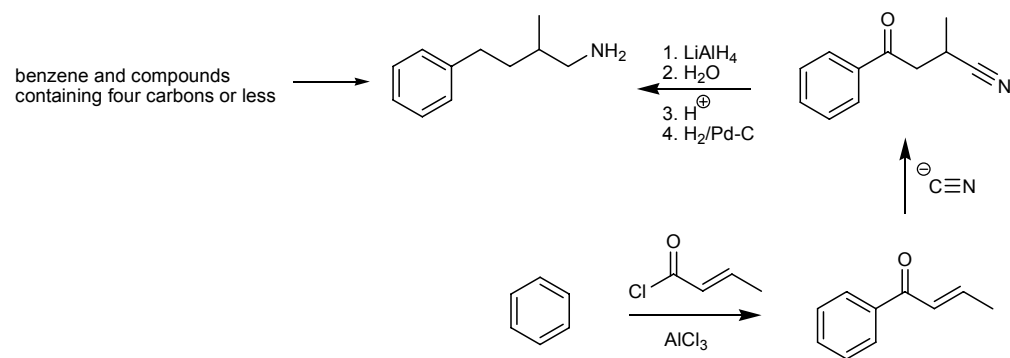
26. The antihistamine *p*-methyldiphenhydramine is shown below.

- Show how *p*-methyldiphenhydramine could be prepared from 4-methylbenzaldehyde. 5 pts
- Show how 4-methylbenzaldehyde could be prepared from benzene and compounds containing four carbon atoms or less. 5 pts



Source

27. Propose a synthesis of the following compound from benzene and any necessary reagents containing four carbon atoms or less. 10 pts



Many other syntheses were acceptable