


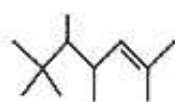
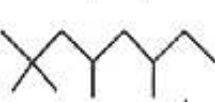
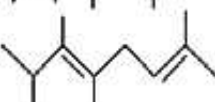
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1. (24 points) Multiple Choice: Circle the best possible answer.

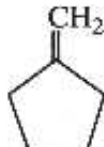
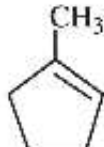
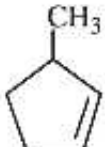
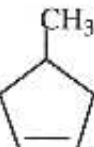
(i) Which reagent(s) listed below would work best in converting 2-methyl-2-hexene to 2-methyl-3-hexanol?

- (A) (1)  $\text{H}_2\text{SO}_4$  (2)  $\text{H}_2\text{O}$
- (B) 50%  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$
- (C) (1)  $\text{BH}_3/\text{THF}$  (2)  $\text{H}_2\text{O}_2, \text{NaOH}$
- (D)  $\text{Br}_2/\text{H}_2\text{O}$

(ii) Which structure corresponds to the trimer of  $(\text{CH}_3)_2\text{C}=\text{CH}_2$  formed under conditions of cationic polymerization?

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

(iii) A compound X,  $\text{C}_6\text{H}_{10}$ , is optically active. Hydrogenation of the compound gives methylcyclopentane. Which compound shown below is compound X?

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

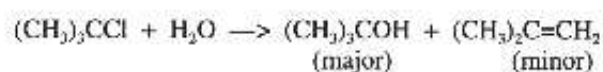
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Multiple Choice (continued): Circle the **best** possible answer.

(iv) Which of the following procedures is the best method to prepare a racemic mixture of (2R,3R)- and (2S, 3S)-2,3-dibromobutane?

- (A) Photochemical bromination of 2-bromobutane
- (B) Addition of HBr to racemic 3-bromo-2-butene
- (C) Addition of Br<sub>2</sub> to *cis*-2-butene
- (D) Addition of Br<sub>2</sub> to *trans*-2-butene

(v) In the solvolysis of *t*-butyl chloride, a **minor product** is 2-methylpropene, which results from the:



- (A) E2 mechanism with OH<sup>-</sup> acting as the base.
- (B) E2 mechanism with H<sub>2</sub>O acting as the base.
- (C) E1 mechanism with OH<sup>-</sup> acting as the base.
- (D) E1 mechanism with H<sub>2</sub>O acting as the base.

(vi) In which of the solvents shown below would the following reaction take place at the fastest rate?

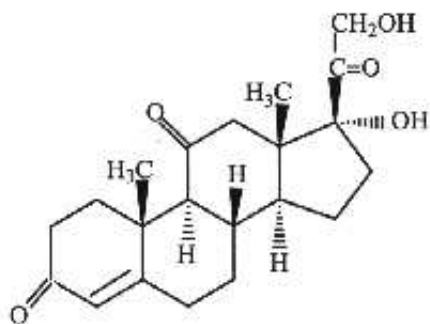


- (A) Ethanol
- (B) Acetic acid
- (C) Water
- (D) Dimethyl sulfoxide

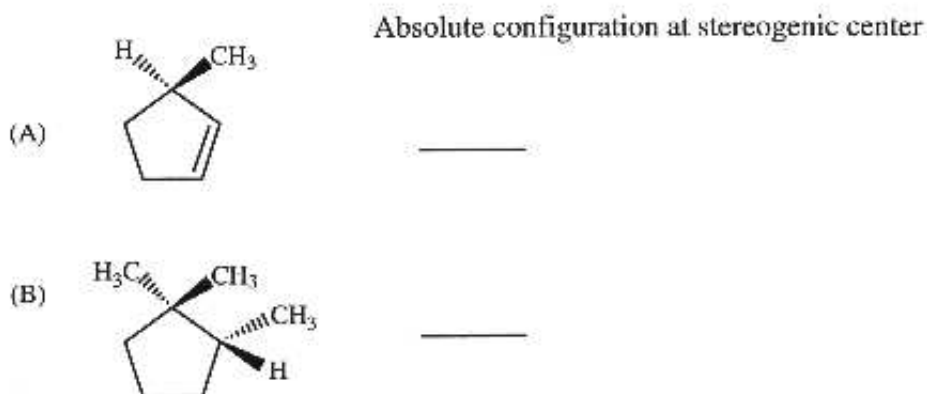
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**2. (19 points)**

- (i) Cortisone is a natural steroid that can be isolated from the adrenal cortex. It has antiinflammatory properties and is used to treat a variety of disorders (e.g., as a topical application for common skin diseases). Circle all the stereogenic centers in the structure of cortisone shown below:



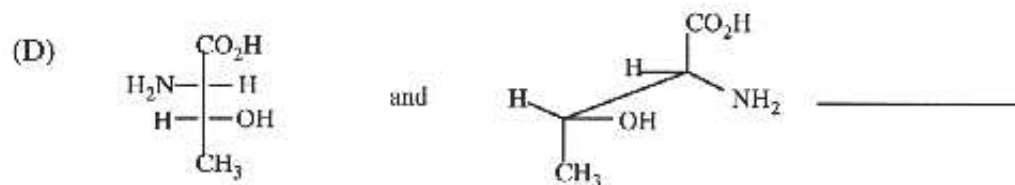
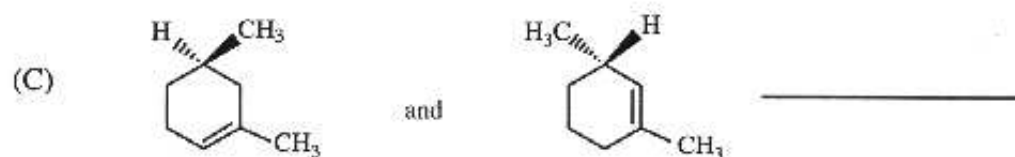
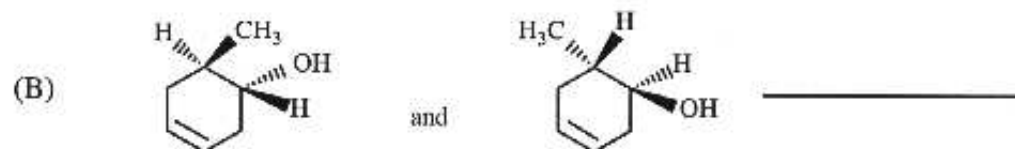
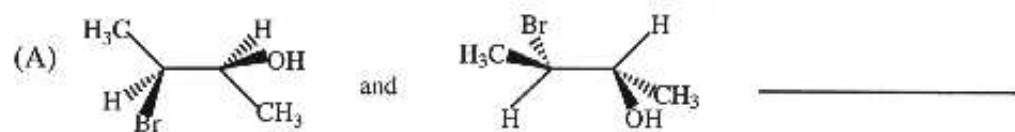
- (ii) Give the absolute configurations at the stereogenic centers of each of the following molecules:



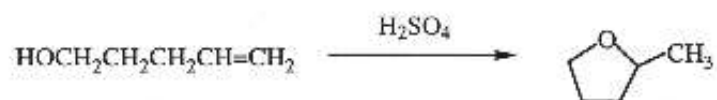
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(iii) Label the following pairs of structures as one of the following:

identical, constitutional isomers, enantiomers, or diastereomers.

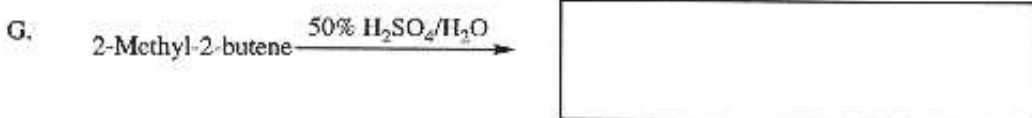
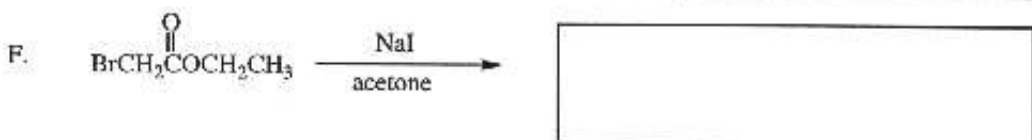
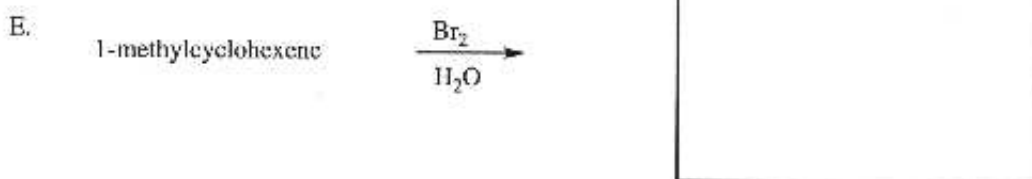
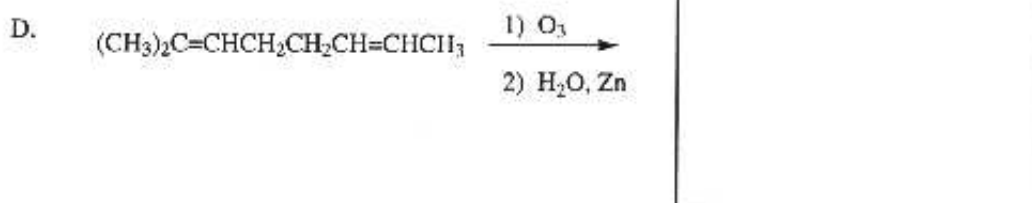
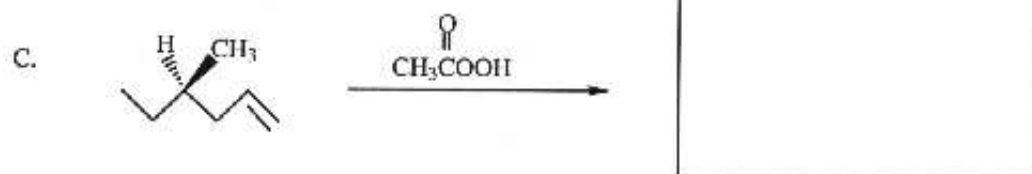
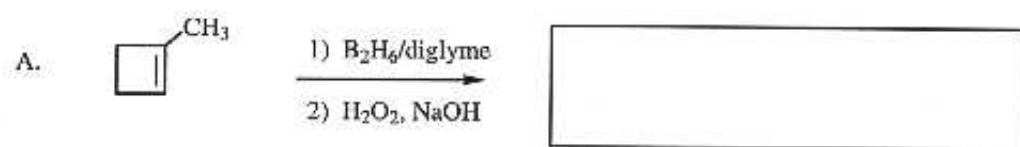


3. (11 points) Propose a mechanism for the following reaction:

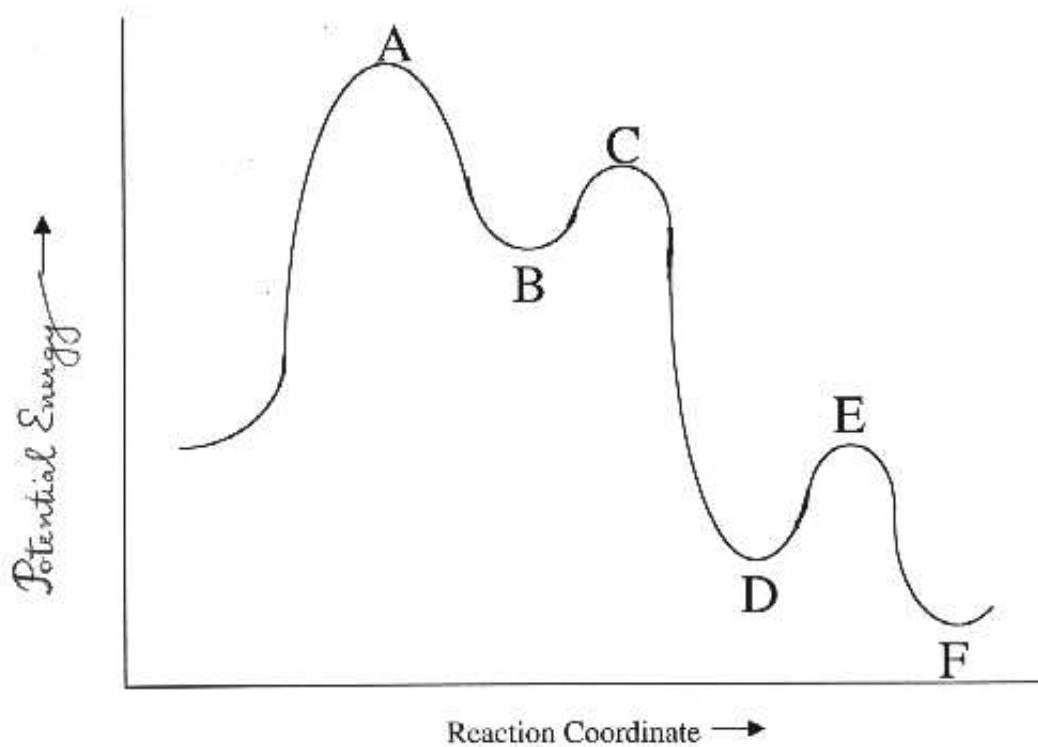


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4. (22 points) Provide the missing reactant, reagents, or products as necessary. **Show the correct stereochemistry where appropriate.**



5. (12 points) Consider the energy diagram illustrating the  $S_N1$  mechanism for the hydrolysis of tert-butyl bromide. Draw the structures of all the species represented by the letters A through F.



6. (12 points) Outline an efficient synthesis of each of the following compounds from the indicated starting material and any necessary organic or inorganic reagents.

A. Ethyl alcohol to 1,2-dicyanoethane

B. 2-bromopropane to 1-bromopropane