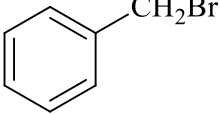
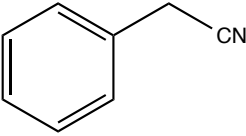
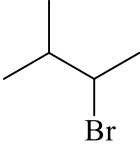
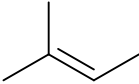
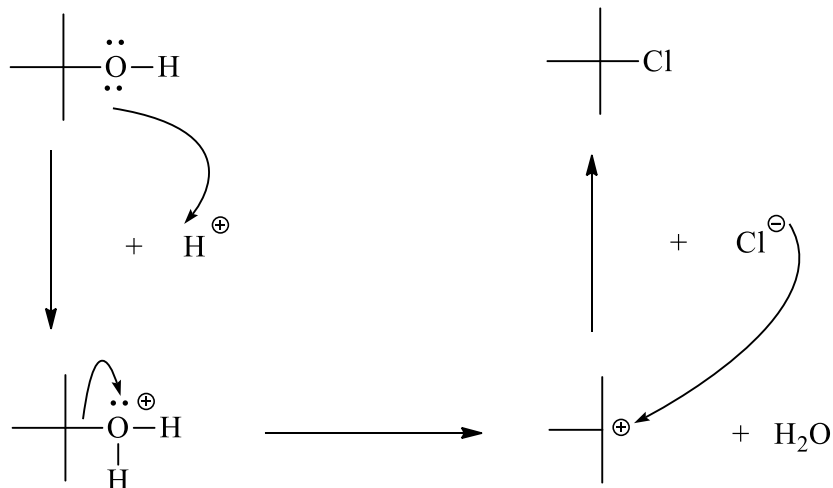


**Marks**  
**2**

- Complete the following table. Make sure you give the name of the starting material where indicated.

STARTING MATERIAL	REAGENTS/ CONDITIONS	STRUCTURAL FORMULA(S) OF MAJOR ORGANIC PRODUCT(S)
	KCN / ethanol (solvent)	
	<b>hot conc. KOH</b> <b>in ethanol solvent</b>	

- Concentrated HCl reacts with 2-methyl-2-propanol in an  $S_N1$  reaction to give 2-chloro-2-methylpropane as shown below. Complete the reaction mechanism by adding curly arrows and formal charges on the intermediates as appropriate.

**Marks**  
**4**

Explain what each part of the abbreviation  $S_N1$  means.

S = **substitution**

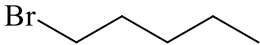
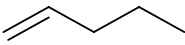
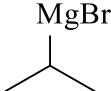
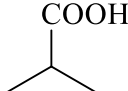
N = **nucleophilic**

1 = **unimolecular**

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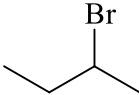

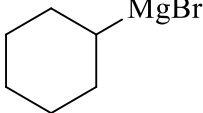
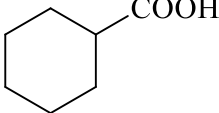
**Marks**  
**2**

- Complete the following table.

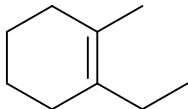
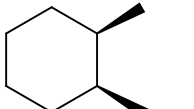
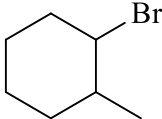
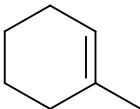
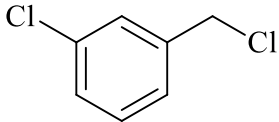
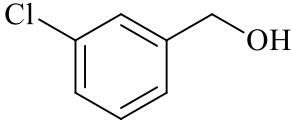
STARTING MATERIAL	REAGENTS/ CONDITIONS	CONSTITUTIONAL FORMULA(S) OF MAJOR ORGANIC PRODUCT(S)
	hot conc. KOH in ethanol solvent	
	1. CO <sub>2</sub> 2. H <sup>+</sup> / H <sub>2</sub> O	

**Marks**  
**2**

- Complete the following table.

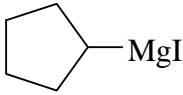

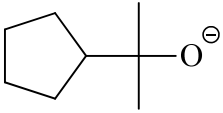
STARTING MATERIAL	REAGENTS/ CONDITIONS	CONSTITUTIONAL FORMULA(S) OF MAJOR ORGANIC PRODUCT(S)
	hot conc. KOH in ethanol	
	1. CO <sub>2</sub> 2. H <sup>+</sup> / H <sub>2</sub> O	

- Complete the following table. If there is no reaction, write "NR". Show any relevant stereochemistry.

STARTING MATERIAL	REAGENTS/ CONDITIONS	CONSTITUTIONAL FORMULA(S) OF MAJOR ORGANIC PRODUCT(S)
	H <sub>2</sub> , Pd/C	
	conc. KOH in ethanol solvent	
	hot aqueous NaOH	

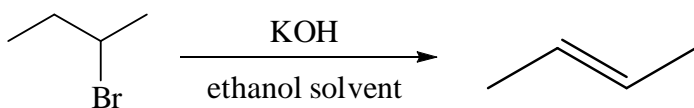
**Marks**  
**1**

- Complete the following table.

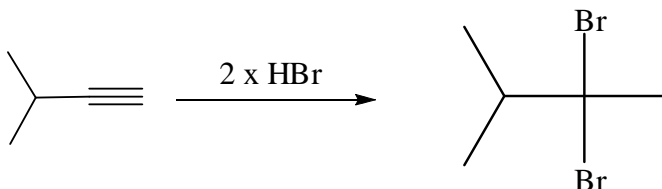
STARTING MATERIAL	REAGENTS/ CONDITIONS	CONSTITUTIONAL FORMULA(S) OF MAJOR ORGANIC PRODUCT(S)
		

**Marks**  
**5**

- Draw the structure of the major organic product formed in the following reactions.



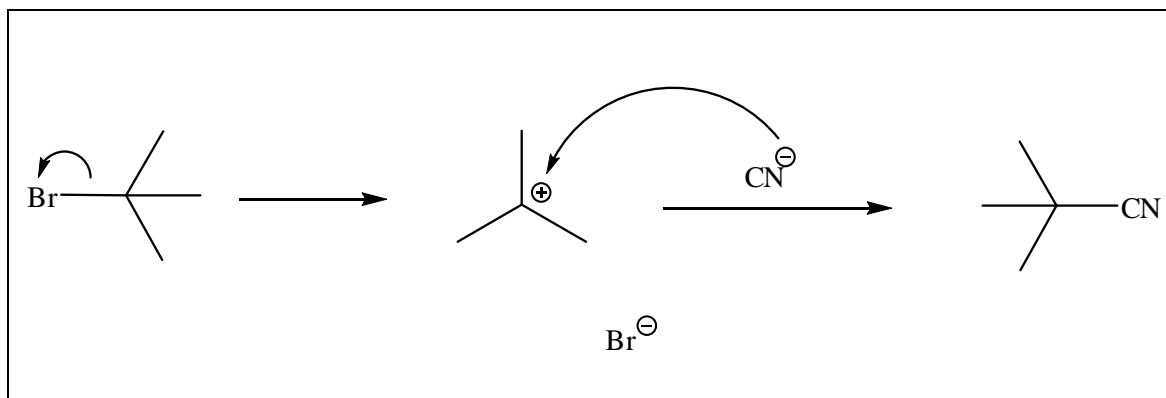
(elimination to give more stable alkene – Zaitsev's rule)



(2 × Markovnikov addition with H adding to less substituted C each time)

**Marks**  
**4**

- Add curly arrows to complete the following mechanism.



Classify this reaction as  $\text{S}_{\text{N}}1$  or  $\text{S}_{\text{N}}2$  and explain what the three parts of this descriptor signify.

**The reaction is an  $\text{S}_{\text{N}}1$  reaction:**

**S = substitution ( $\text{Br}^-$  is substituted for  $\text{CN}^-$ )**

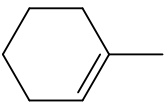
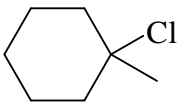
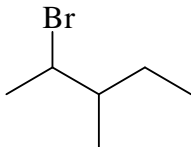
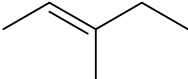
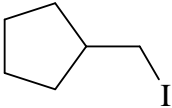
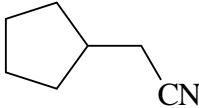
**N = nucleophilic ( $\text{CN}^-$  is negatively charged and attacks the positively charged carbon)**

**1 = unimolecular (the first step, involving breaking a C-Br bond, is rate determining and involves only one molecule).**



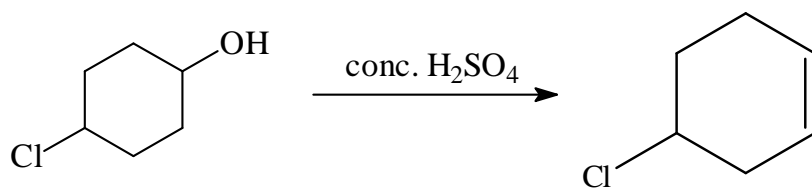
**Marks**  
**3**

- Complete the following table.

Starting material	Reagents / Conditions	Major organic product(s)
	HCl	
	hot conc. KOH ethanol (solvent)	
	$\text{CN}^-$	

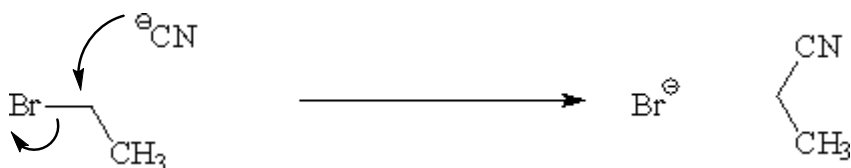
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- |              |
|--------------|
| <b>Marks</b> |
| <b>5</b>     |



**Marks**  
**5**

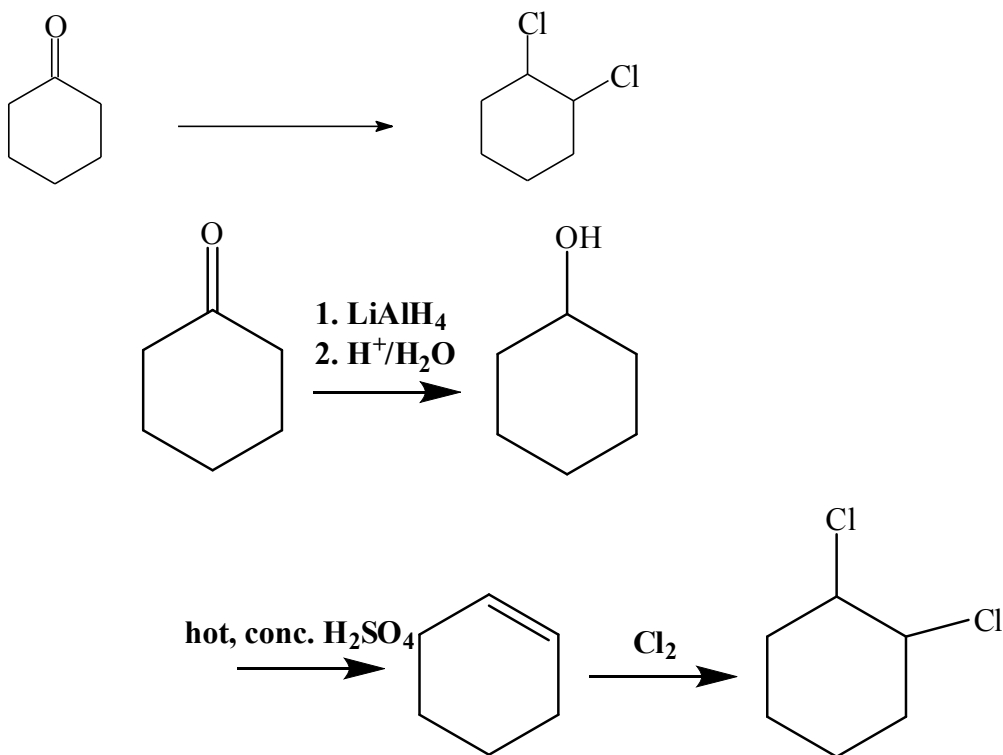
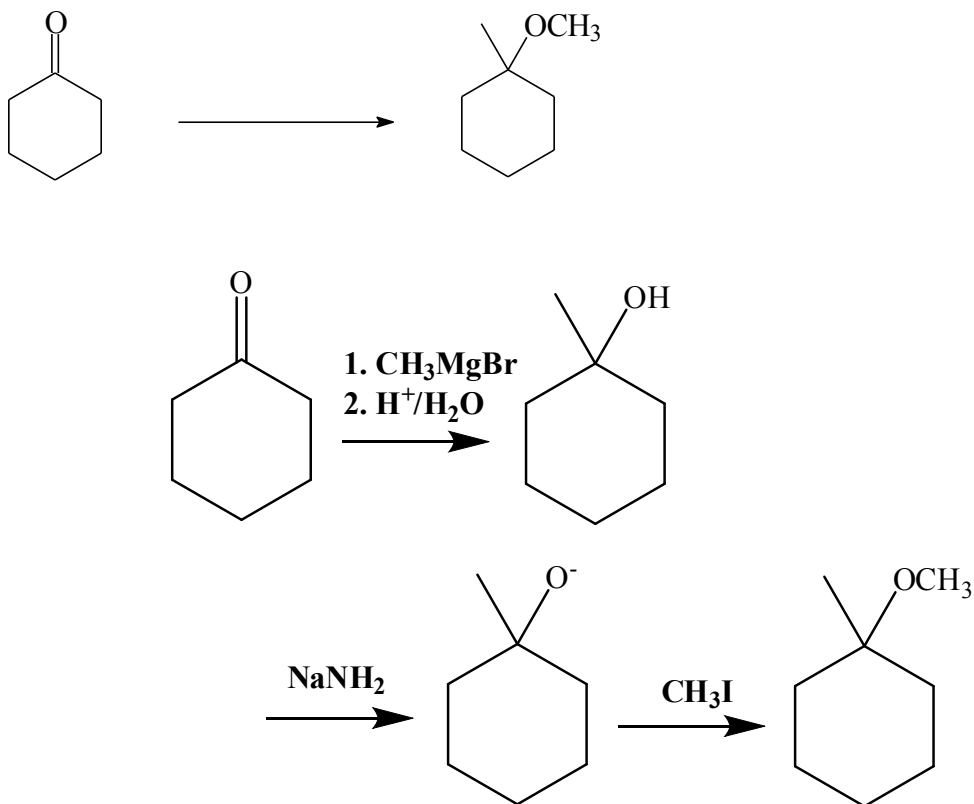
- Add curly arrows to complete the following mechanism.



Classify this reaction as  $S_N1$  or  $S_N2$  and explain what the three parts of this descriptor signify.

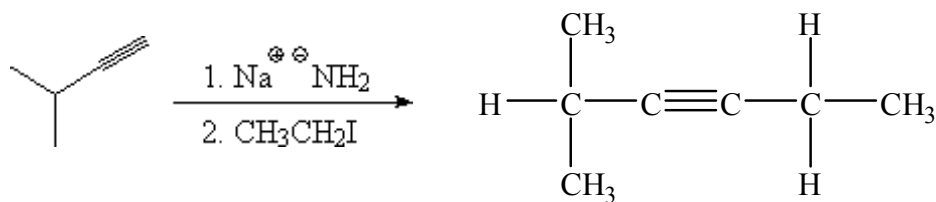
**The reaction is  $S_N2$ : a substitution ('S') ( $CN^-$  for  $Br^-$ ) involving nucleophilic ('N') attack of  $CN^-$  on the substrate. The rate determining step is bimolecular as two ('2') molecules ( $CN^-$  and  $CH_3CH_2Br$ ) are involved.**

- Devise a synthesis of the following compounds from the starting material indicated. Note that more than one step may be required and you should indicate all necessary steps and the constitutional formulas of any intermediate compounds.



**Marks**  
**2**

- Give the constitutional formula and the name of the major organic product of each of the following reactions.

Name: **2-methylhex-3-yne**