esf european social fund in the czech republic
EUROPEAN UNION
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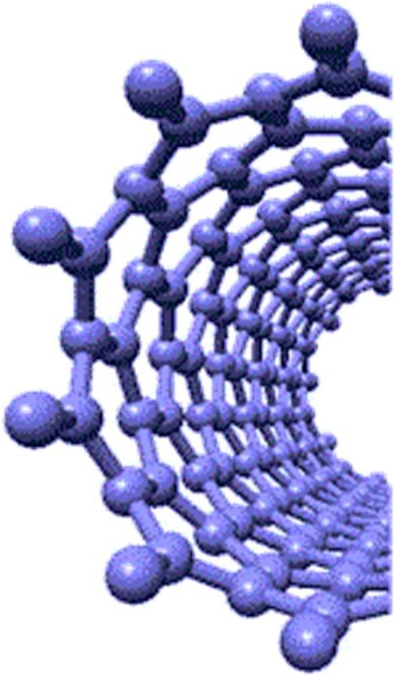
INVESTMENTS IN EDUCATION DEVELOPMENT

Innovation and Development of Study Field Nanomaterials at the Technical University of Liberec

nano.tul.cz



These materials have been developed within the ESF project: Innovation and development of study field Nanomaterials at the Technical University of Liberec

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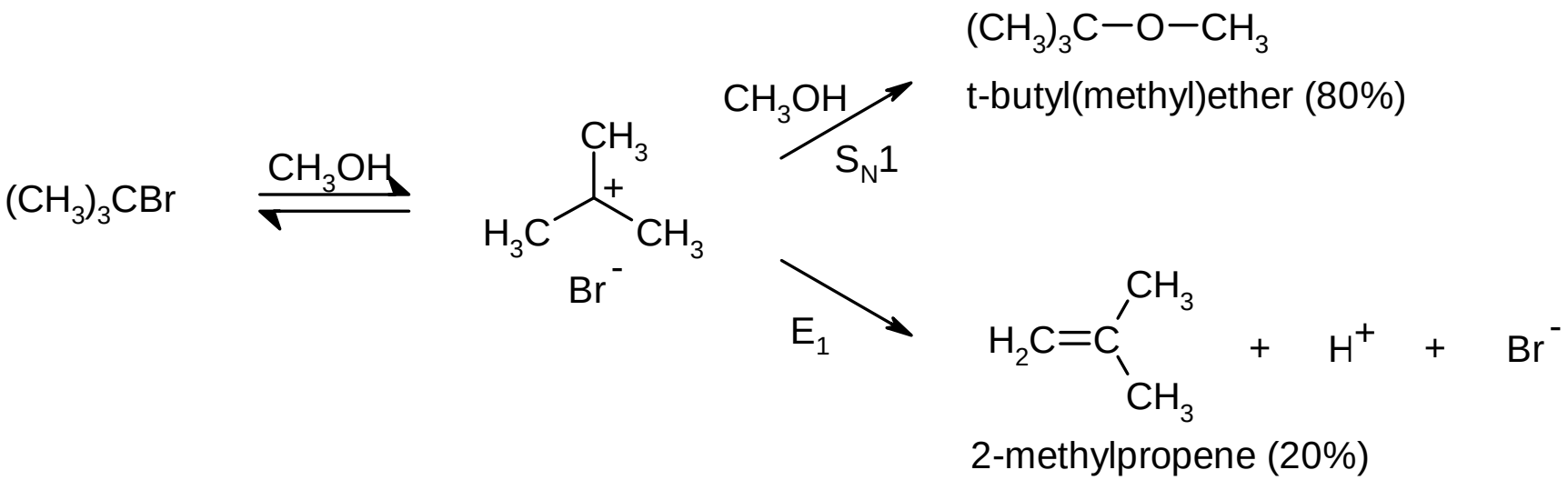
Halogenderivatives – E1:

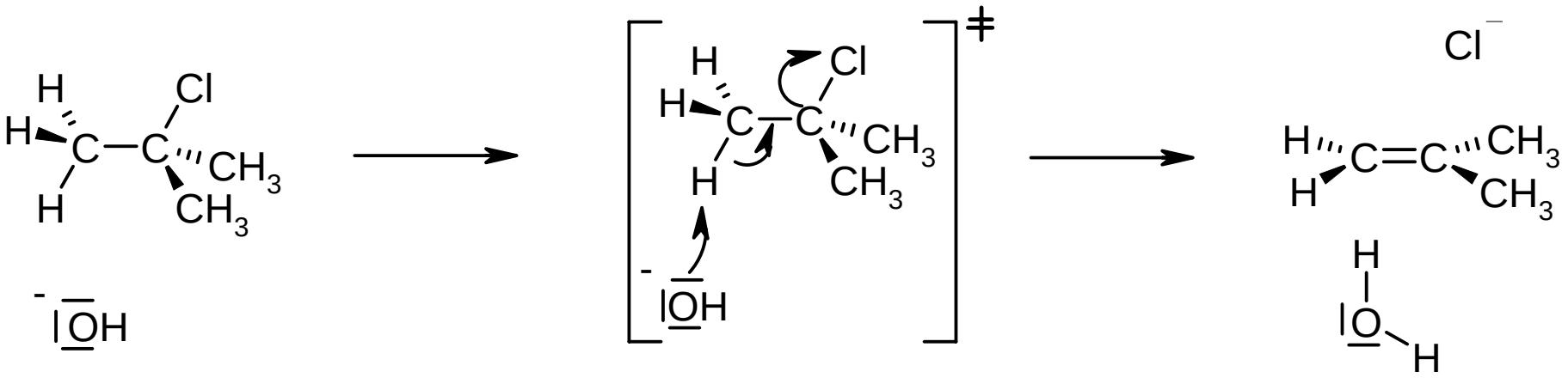
- elimination is always competing with substitution

.

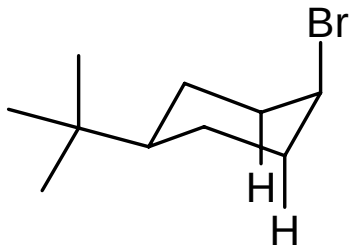


Halogenderivatives – E2:

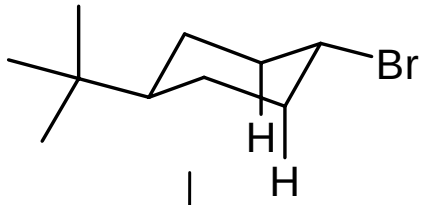
- elimination is always competing with substitution
- basicity and bulkiness is favourable for elimination

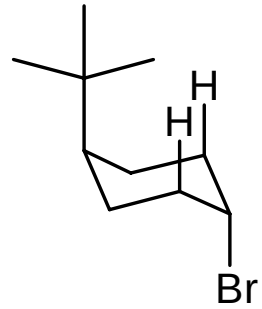


Halogenderivatives – E2:
- stereochemical preference



cis-4-*terc*-butylcyklohexylbromide

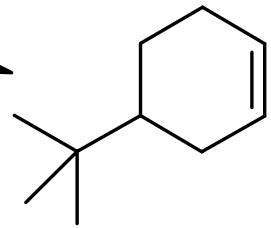




trans-4-*terc*-butylcyklohexylbromide

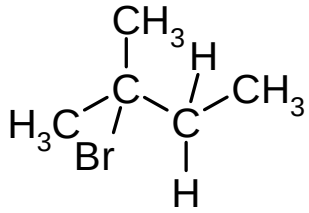
E_2

E_2

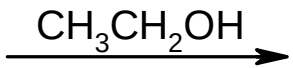


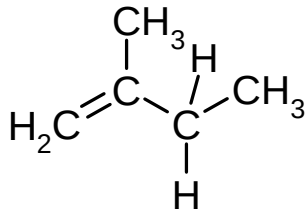
4-*terc*-butylcyclohexene

Halogenderivatives – E2: - regioselectivity - Zaitsev rule



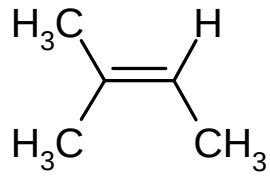
2-bromo-2-methylbutane



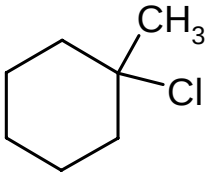


2-methylbut-1-ene (25%)

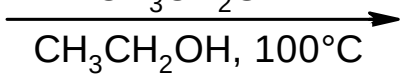
+

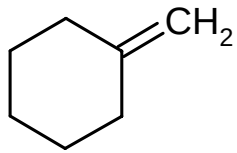


2-methylbut-2-ene (75%)



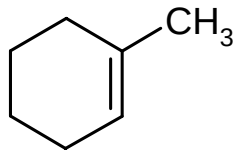
1-chloro-1-methylcyclohexane





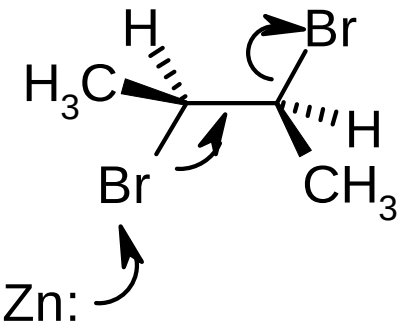
methylencyclohexane (6%)

+



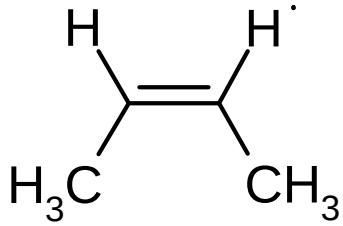
1-methylcyclohexene (94%)

Halogenderivatives – E2: - dehalogenation



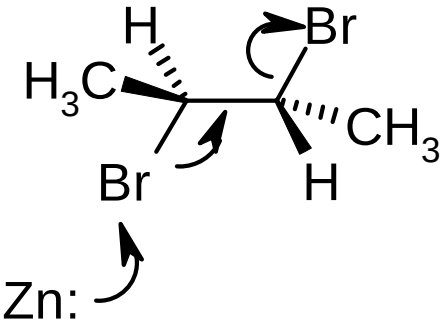
threo-2,3-dibromobutane

acetone



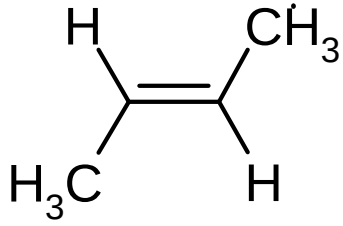
(*Z*)-but-2-ene

+ $ZnBr_2$



erythro-2,3-dibromobutane

acetone



(*E*)-but-2-ene

+ $ZnBr_2$

Organic Chemistry – functional groups

Halogenderivatives : technically important products

$$CH_4 \xrightarrow[h\nu,\ 80 - 100\ ^\circ C]{Cl_2} \underset{\text{chloromethane (15\%)}}{CH_3Cl} + \underset{\text{dichloromethane (37\%)}}{CH_2Cl_2} + \underset{\text{trichloromethane (38\%)}}{CHCl_3} + \underset{\text{tetrachloromethane (10\%)}}{CCl_4}$$

$$HC{\equiv}CH + HCl \xrightarrow[\text{charcoal}]{HgCl_2} \underset{\text{chloroethylene - vinylchloride}}{H_2C{=}CHCl}$$

$$H_2C{=}CH_2 + Cl_2 \xrightarrow{500\ ^\circ C} \underset{\text{chloroethylene}}{H_2C{=}CHCl} + HCl$$

Halogenderivatives : technically important products

$$H_2C{=}CHCH_3 + Cl_2 \xrightarrow{500 - 600\ ^\circ C} H_2C{=}CHCH_2Cl + HCl$$

3-chloropropene

$$3\ CHCl_3 + 6\ HF \xrightarrow{SbF_3,\ SbCl_5} 3\ CHClF_2 + 6\ HCl$$

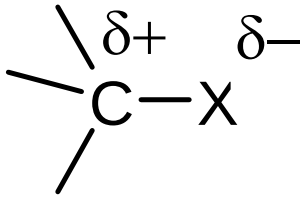
chlorodifluoromethane

$$2\ CHClF_2 \xrightarrow{650 - 800\ ^\circ C} F_2C{=}CF_2 + 2HCl$$

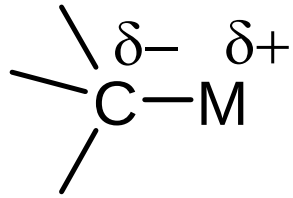
tetrafluoroethylene

Organic Chemistry – functional groups

Halogenderivatives : organometallic chemistry



X is more electronegative then Carbon (X = halogene)

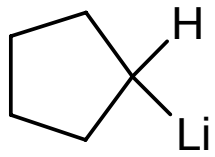


M is less electronegative (more positive) than Carbon (M = metal)

Element	Electronegativity	Element	Electronegativity	Element	Electronegativity
F	**4,1**	**K**	**0,9**	**Zn**	**1,7**
Br	**2,7**	**Li**	**1,0**	**Hg**	**1,9**
C	**2,5**	**Mg**	**1,2**	**Cu**	**1,9**

Organic Chemistry – functional groups

Halogenderivatives : organometallic chemistry - nomenclature



cyclopentyllithium

$H_2C{=}CHNa$

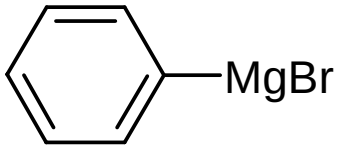
vinylnatrium

$(CH_3CH_2)_2Mg$

diethylmagnesium

$(CH_3)_2Zn$

dimethylzinc



phenylmagnesium chloride

CH_3ZnI

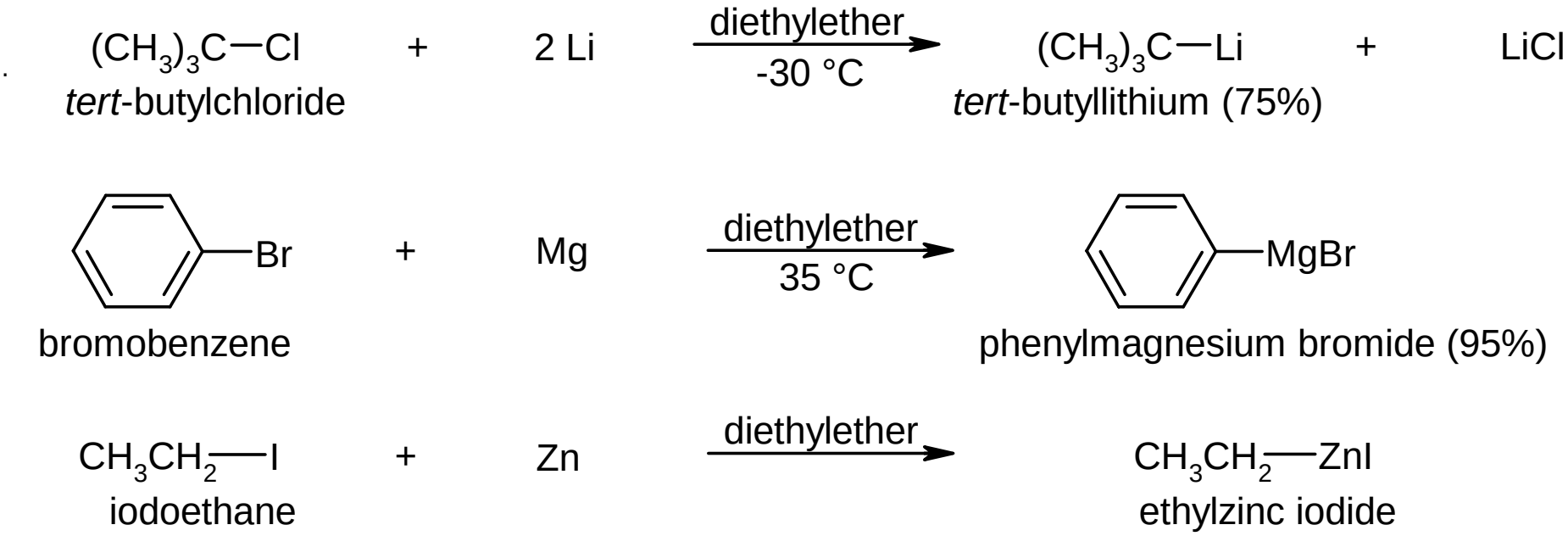
methylzinc iodide

$(CH_3)_2AlCl$

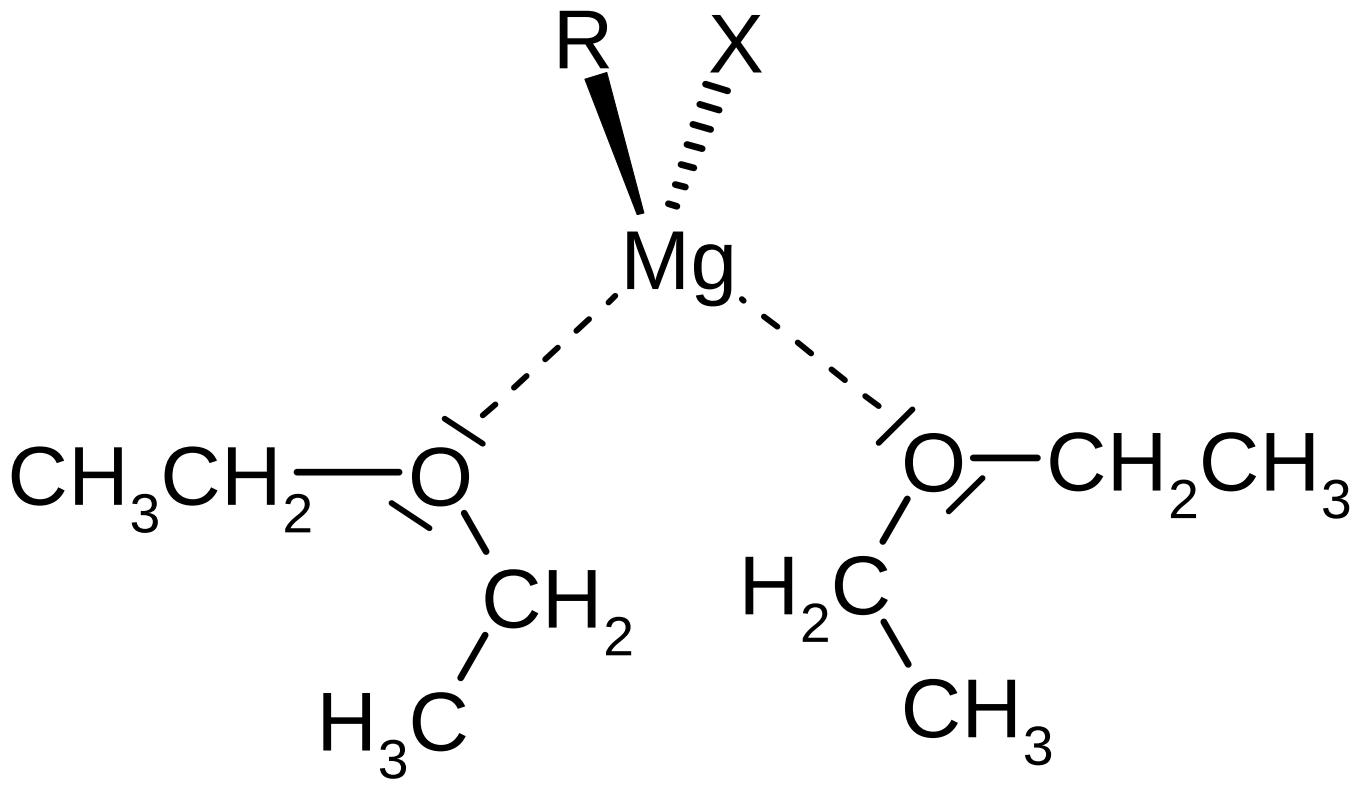
dimethylaluminium chloride

Organic Chemistry – functional groups

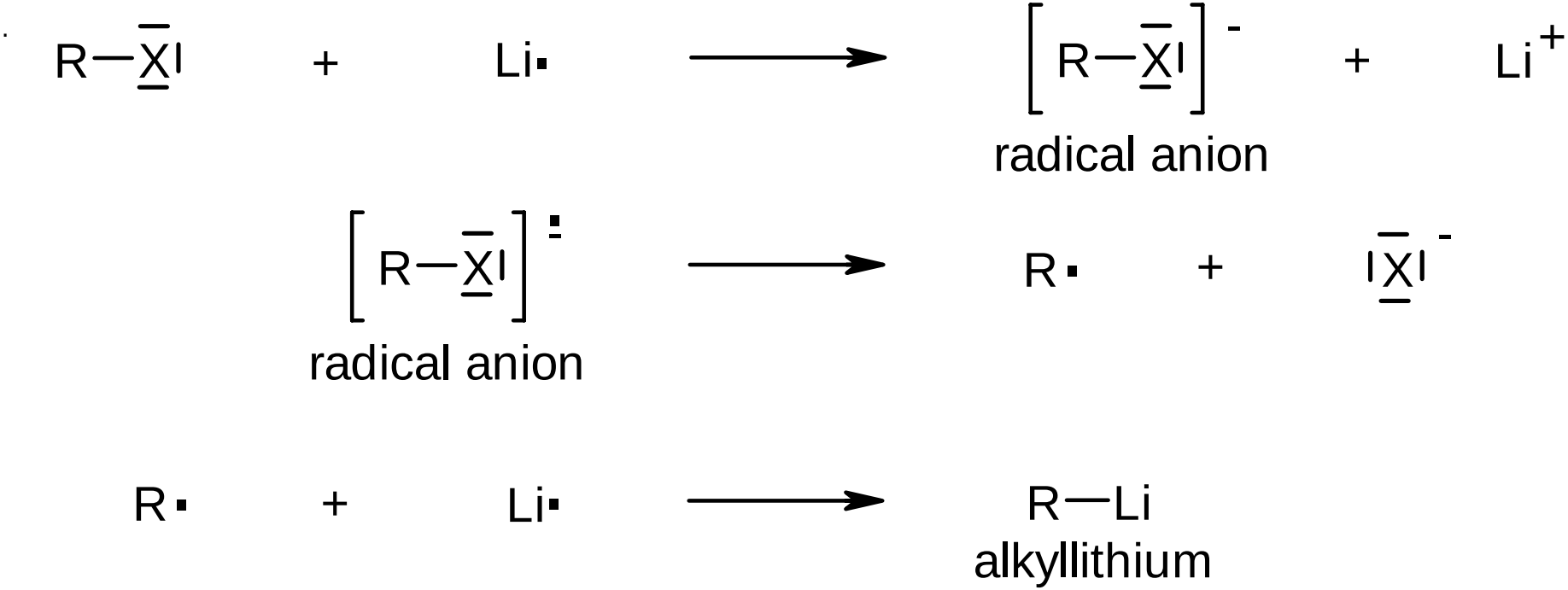
Halogenderivatives : organometallic chemistry - preparation



Halogenderivatives : organometallic chemistry – the role of ether



Organometallic reagent – mechanism of formation



Organometallic reagent – metal exchange

$CdI_2 + 2CH_3Li \longrightarrow (CH_3)_2Cd + 2LiI$

dimethylcadmium

$SiCl_4 + C_6H_5MgCl \longrightarrow C_6H_5SiCl_3 + MgCl_2$

trichlorphenylsilan

$SiCl_4 + 4\ C_6H_5MgCl \longrightarrow (C_6H_5)_4Si + 4\ MgCl_2$

tetraphenylsilan

$PbO_2 + 4\ CH_3CH_2MgBr \longrightarrow (CH_3CH_2)_4Pb + 4\ MgBr_2$

tetraethyllead

Organometallic reagent – reaction with acidic „H“

CH_3CH_2MgBr + H_2O ⟶ CH_3CH_3 + $Mg(OH)Br$

ethylmagnesium bromide — ethane

CH_3CH_2MgBr + CH_3OH ⟶ CH_3CH_3 + $Mg(OCH_3)Br$

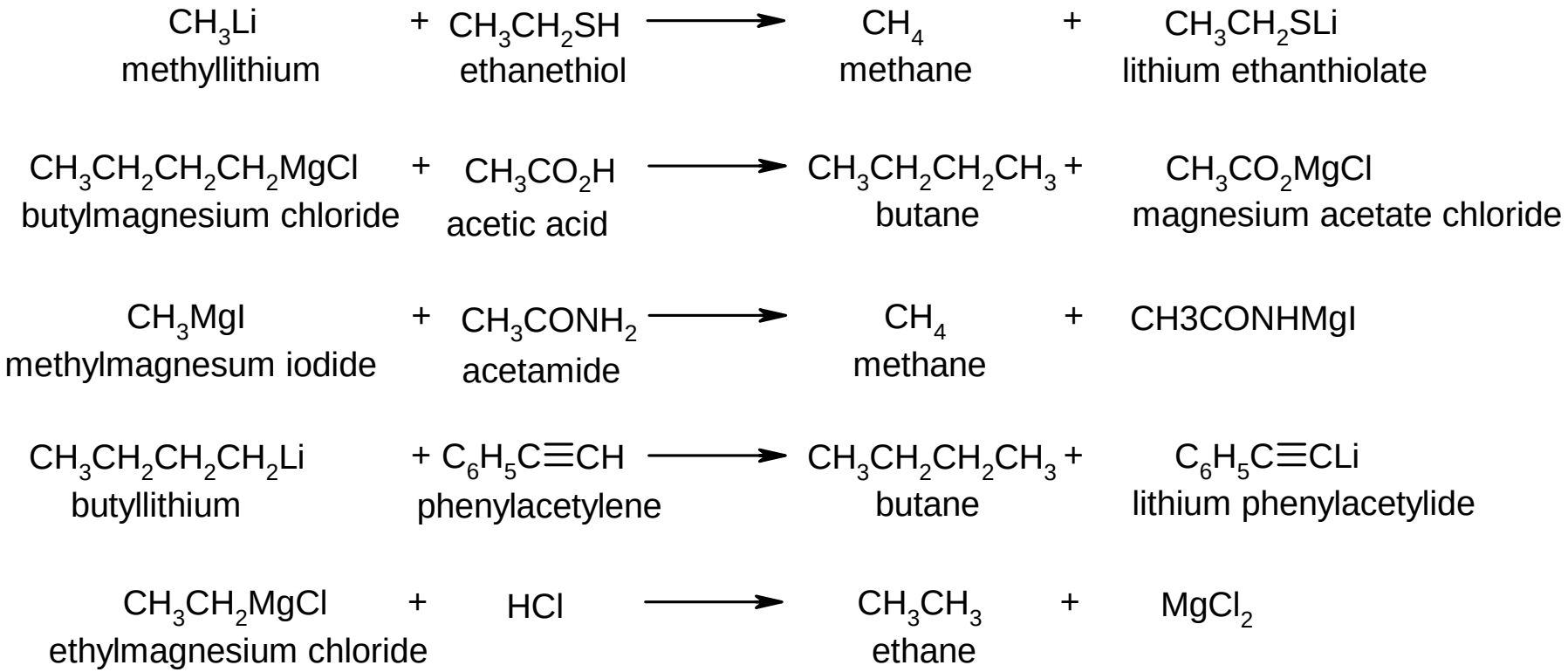
ethylmagnesium bromide — ethane

C_6H_5Li + $(CH_3)_2NH$ ⟶ C_6H_6 + $(CH_3)_2NLi$

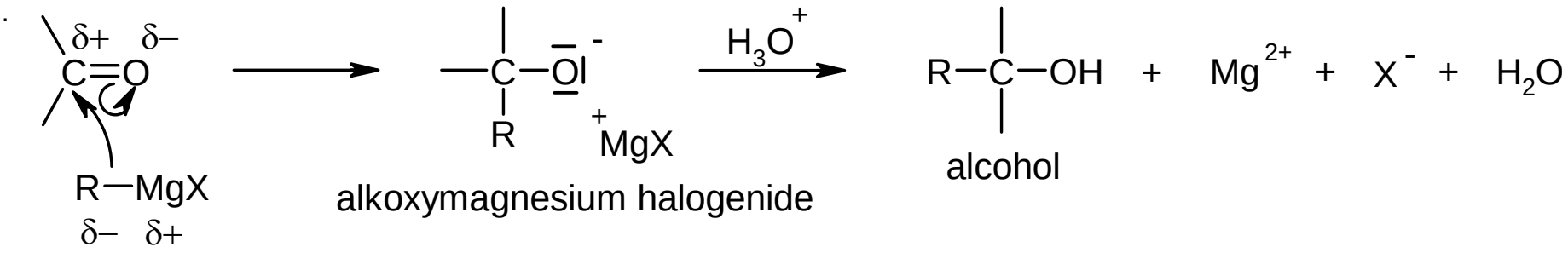
dimethylamine — benzene — lithium dimethylamide

Organic Chemistry – functional groups

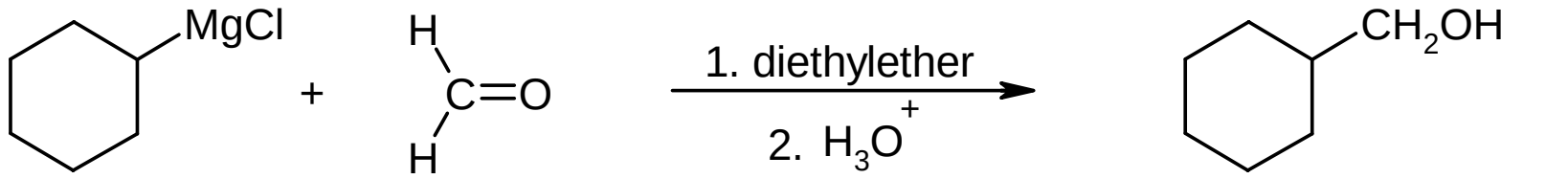
Organometallic reagent – reaction with acidic „H“



Organanometallic reagent – synthesis of alcohols (A_N to C=O)



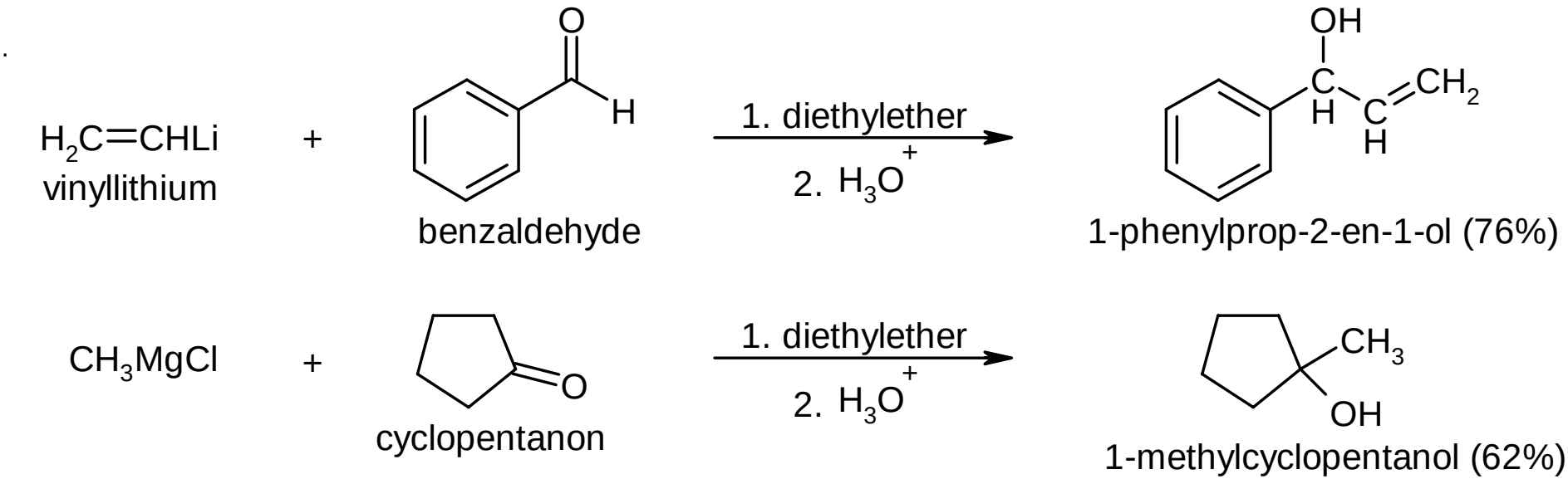
alkoxymagnesium halogenide



cyclohexylmagnesium chloride

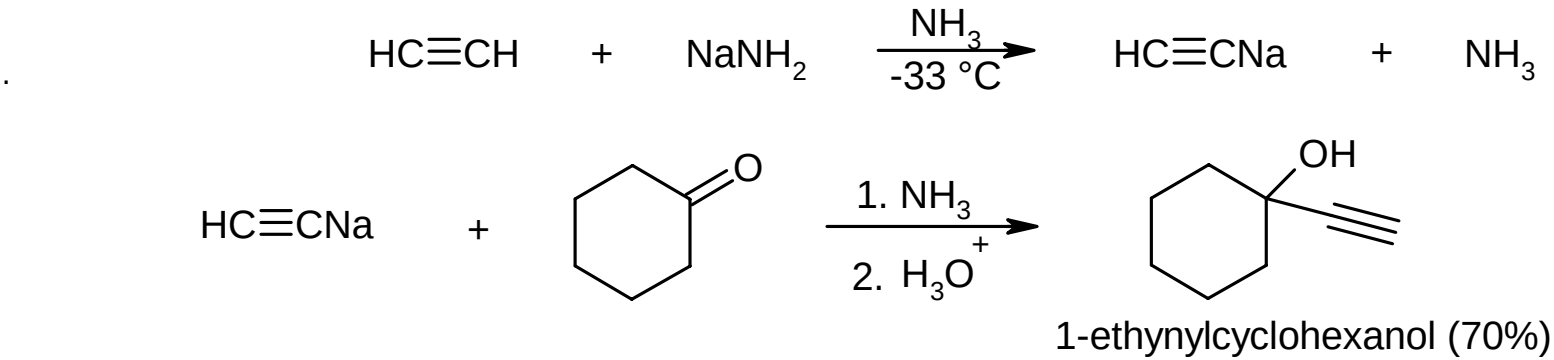
cyclohexylmethanol (64%)

Organometallic reagent – synthesis of alcohols (A_N to C=O)

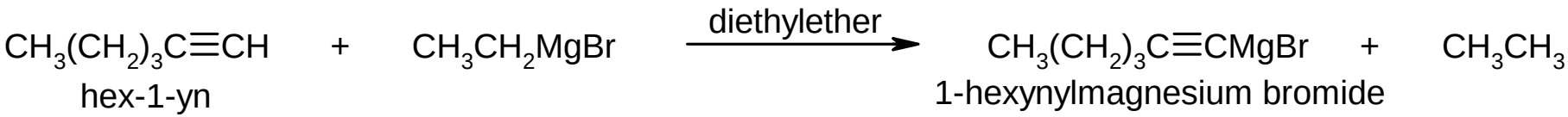


Organic Chemistry – functional groups

Organometallic reagent – synthesis of alcohols (A_N to C=O)

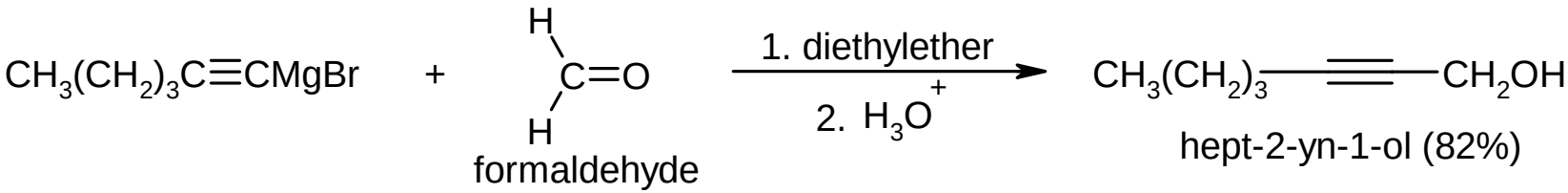


1-ethynylcyclohexanol (70%)



hex-1-yn

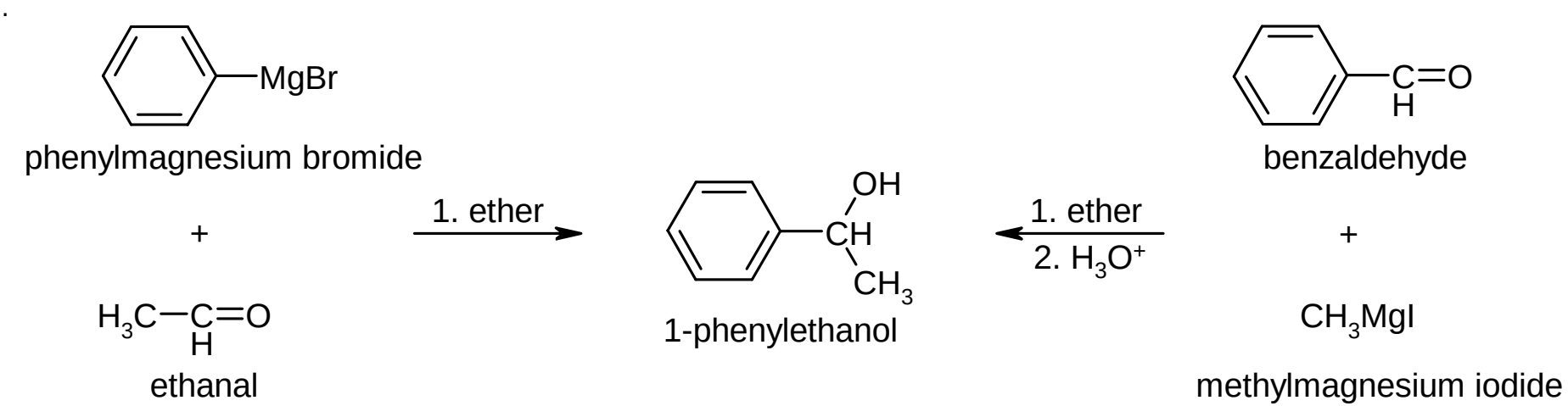
1-hexynylmagnesium bromide



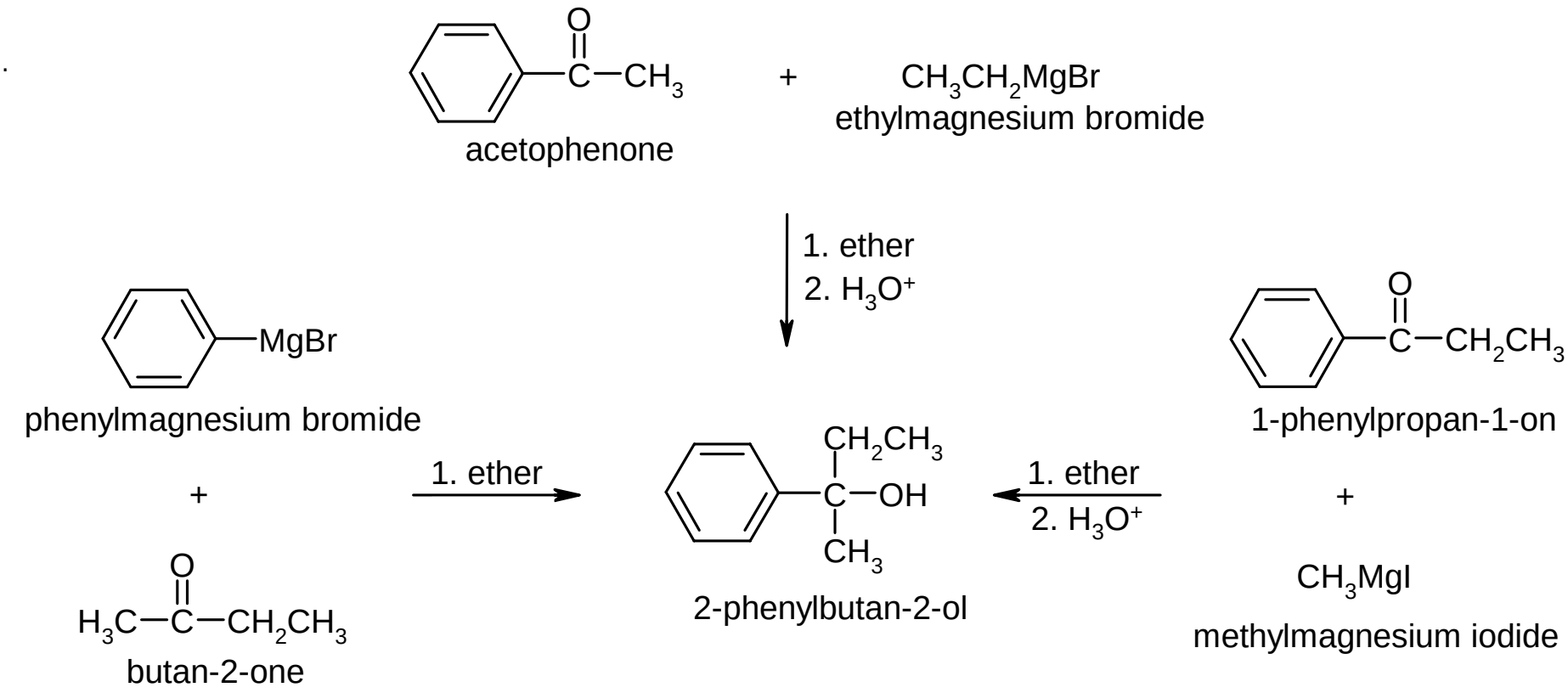
formaldehyde

hept-2-yn-1-ol (82%)

Organometallic reagent – synthesis of alcohols (A_N to C=O)



Organometallic reagent – synthesis of alcohols (A_N to C=O)



Organometallic reagent – synthesis of alcohols (A_N to C=O)