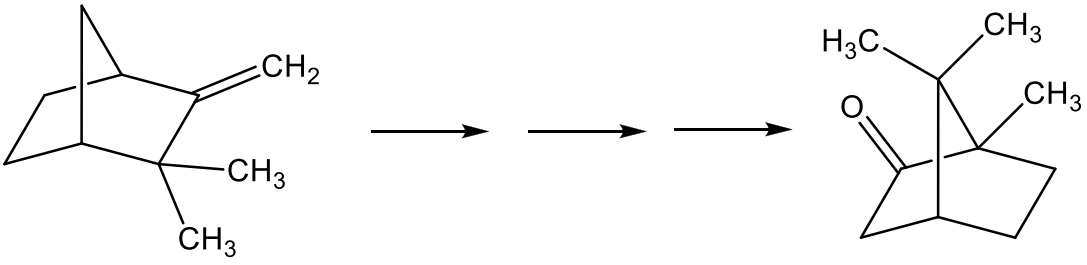
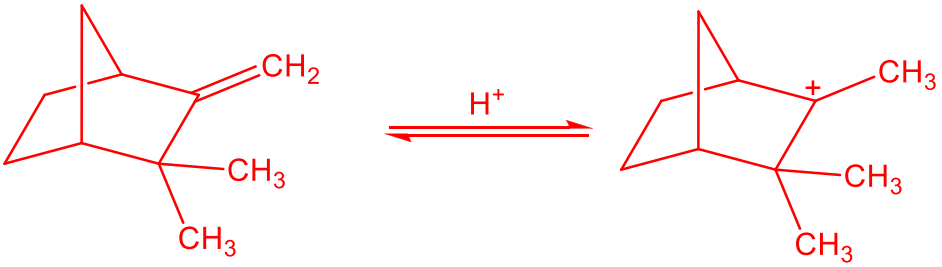
Exercise 5 : - Acid-Base Reactions

1. Camphor is terpene which has many varied uses such as a plasticizer and in fireworks. Even though it is a naturally occurring compound, the high demand for this compound requires an additional synthetic source. Camphene is a readily available terpene and is used in the synthesis. The first step in the reaction involves treatment of camphene with an acetic acid/sulfuric acid mixture.



camphene camphor

Write an equation for the first step in this synthetic sequence.



2. The following table lists pK_a values for a selection of acids in aqueous solution:

Acid	pK_a	Acid	pK_a	Acid	pK_a
HI	-10	$CH_3OH_2^+$	-2,5	CH_3OH	16
H_2SO_4	-9	H_3O^+	-1.74	$(CH_3)_2C=O$	19.2
HBr	-9	CH_3CO_2H	4.75	$HC\equiv CH$	25
HCl	-7	NH_4^+	9.2	NH_3	38
$(CH_3)_2OH^+$	-3.8	C_6H_5OH	9.9	$H_2C=CH_2$	44
$(CH_3)_2C=OH^+$	-2.9	$CH_3NH_3^+$	10.6	C_2H_6	50

   a. Will dimethyl ether, $(CH_3)_2O$, dissolve in concentrated sulfuric acid, H_2SO_4? Explain your answer.

      Yes. $(CH_3)_2OH^+$ (pK_a = -3.8) is a weaker acid than H_2SO_4 (pK_a = -9)

b. Will dimethyl ether, $(CH_3)_2O$, dissolve in acetic acid, CH_3CO_2H? Explain your answer.

No. $(CH_3)_2OH^+$ (pK_a = -3.8) is a stronger acid than CH_3CO_2H (pK_a = 4.75)

3. Arrange the following compounds in order of decreasing acidity:

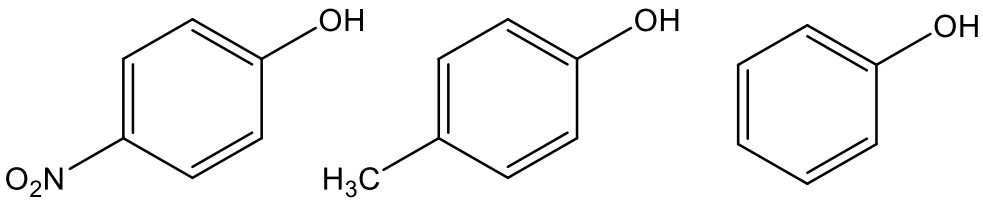
a.

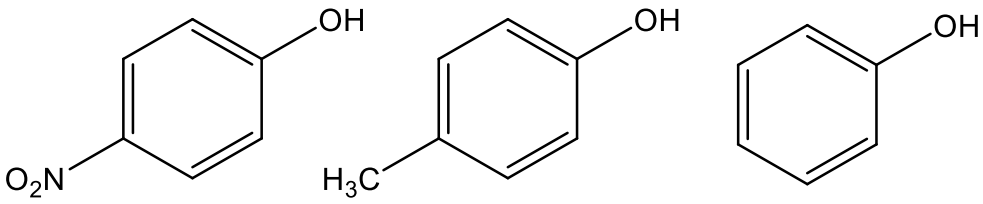
$CH_3CH_2CH_3$ $H_3CC{\equiv}CH$ $CH_3CH{=}CH_2$

$CH_3CH_2CH_3$ $H_3CC{\equiv}CH$ $CH_3CH{=}CH_2$

3 1 2

b.





1 3 2

c.

$CH_3CH_2CO_2H$ $CH_3CHClCO_2H$ $CH_3CH_2CH_2OH$

$CH_3CH_2CO_2H$ $CH_3CHClCO_2H$ $CH_3CH_2CH_2OH$

2 1 3