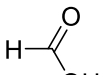
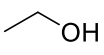
Thanks to the inductive and/or the mesomeric effects, classify these molecules from the less to the most acid.

A

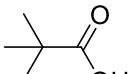


B

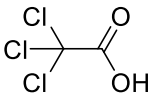
C



D



E



F

Acidity is the ability to loss a proton. First you must determine the most labile X-H bond in each structure.

Lability of a X-H bond is related to polarity : the more electronegative X is, the more polar the X-H bond is, the more labile the proton is.

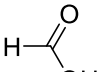
First we consider the polarity of the bond:

In the structures above, all present a polar O-H bond except compound **C** which only presents non polar C-H bond.

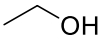
So in the case of the ketone **C**, the C-H bond is less polar than in the other structures, the proton is less labile and compound **C** is the less acidic among the six compounds. **RANK 6**

For the five other structures, you must consider the inductive and/or mesomeric effect.

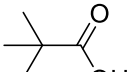
A



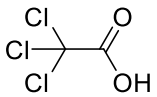
B



D



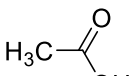
E



F

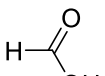
- A withdrawing effect, either inductive or mesomeric, weakens the O-H bond by increasing its polarity and so increases the acidity of the compound.
- On the contrary, donating effect, either inductive or mesomeric, strengthens the O-H bond by decreasing its polarity and so decreases the acidity of the compound.
- Mesomeric effects are superior to inductive effects. In the structures,

The effects are summarized below:



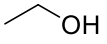
A

-M (CO)
-I (CO)
+I (CH_3)



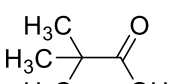
B

-M (CO)
-I (CO)



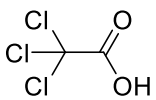
D

+I (alkyl)



E

-M (CO)
-I (CO)
+4I (4 C)

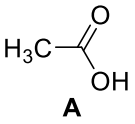


F

-M (CO)
-I (CO)
-3I (3 Cl)

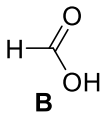
Four structures possess a R-C=O substituant presenting a mesomeric withdrawing effect -M (compounds **A**, **B**, **E** and **F**) increasing the acidity while compound **D** presents no mesomeric effect . So among these five structures, the less acidic among them is compound **D = RANK 5**.

Finaly, we must rank the four remaining carboxylic acids **A**, **B**, **E** and **F**



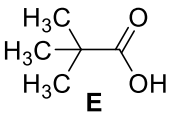
A

-M (CO)
-I (CO)
+I (CH_3)



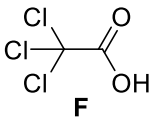
B

-M (CO)
-I (CO)



E

-M (CO)
-I (CO)
+4I (4 C)



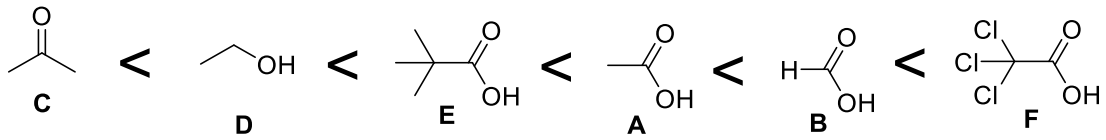
F

-M (CO)
-I (CO)
-3I (3 Cl)

The only difference between them is the group after the C=O double bond : a methyl for compound **A**, an hydrogen for compound **B**, a tert-butyl for compound **E** and trichloromethyl for compound **F**. Her ewe must compare the remaining inductive effect :

- Compound **F** is the only compound possessing only withdrawing inductive effect increasing the acidity of the compound. It is the most acidic => **RANK 1**
- Compound **A** and **E** has donating effect decreasing acidity while compound **B** has no donating effect => Compound **B** is the most acid between the three compounds => **RANK 2**
- The difference between **A** and **E** is the number of carbons in the alkyl chain. The most carbons you have the most important is the donating inductive effect and the less acidic is the compound. So compound **E** is less acidic than **A**. **A = RANK 3** and **E = RANK 4.**

In conclusion, we can rank these compounds from the less to the most acidic :



C < **D** < **E** < **A** < **B** < **F**