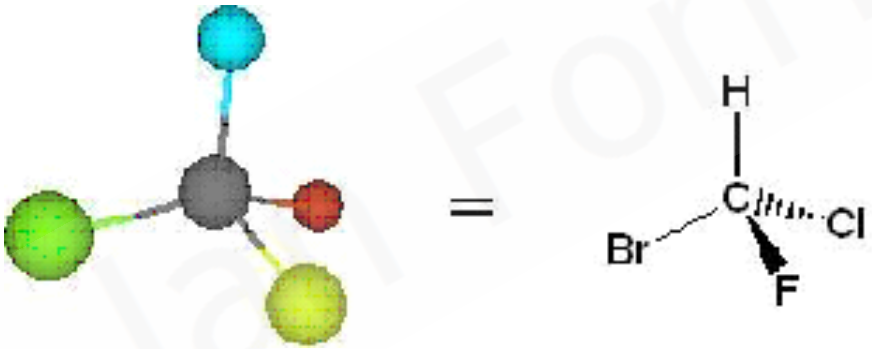
4.6B Chiral Carbon Atoms

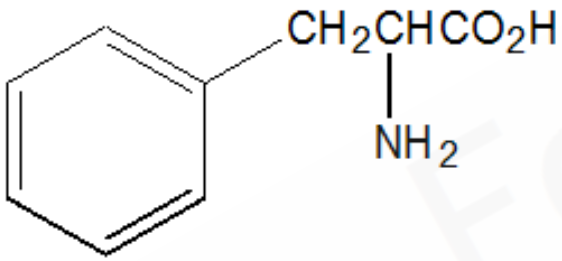
A **chiral** carbon atom has
four different groups attached to it.

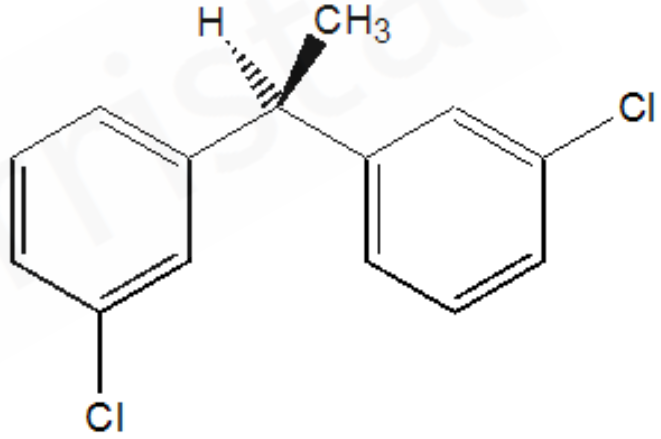


The molecule above is chiral because there are four different atoms attached to the central carbon: hydrogen, bromine, chlorine and fluorine.

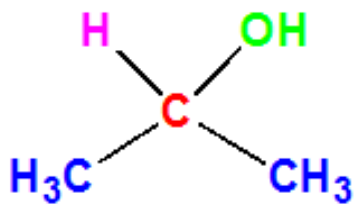
Which of the following molecule(s) have a **chiral carbon**?

$(CH_3)_2CHOH$

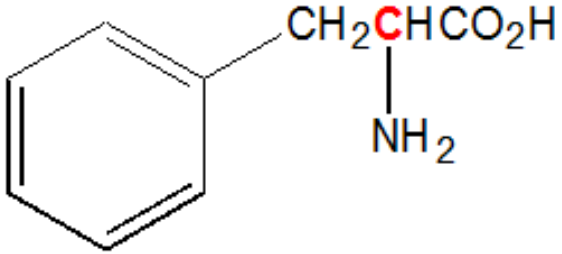




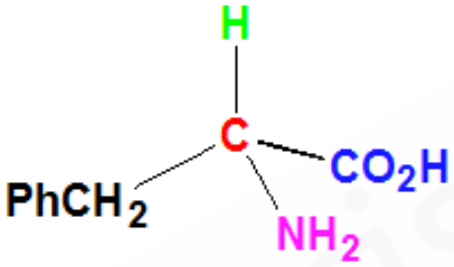
$(CH_3)_2CHOH$ =



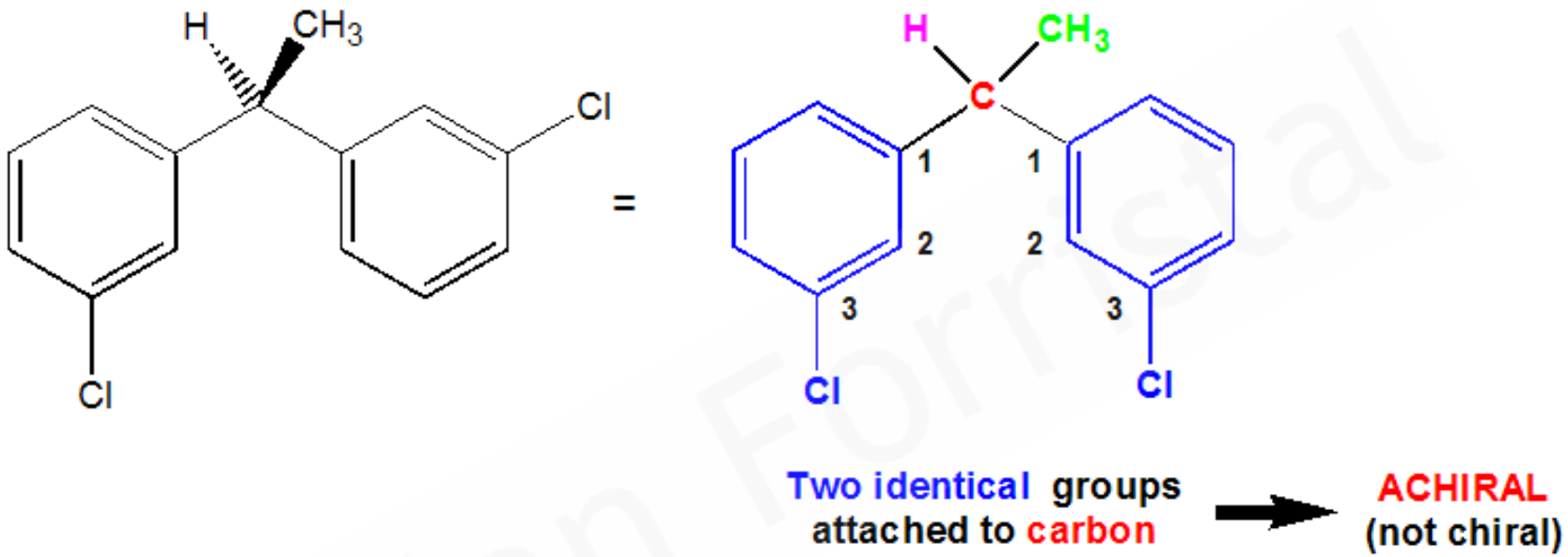
Two identical groups attached to carbon → ACHIRAL (not chiral)



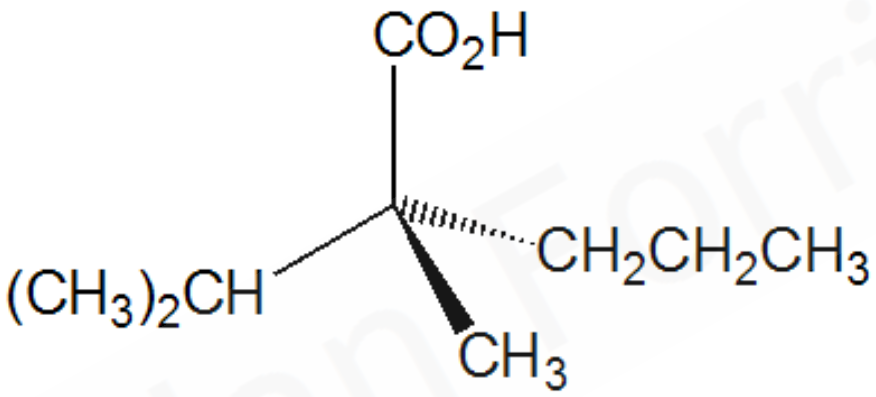
=



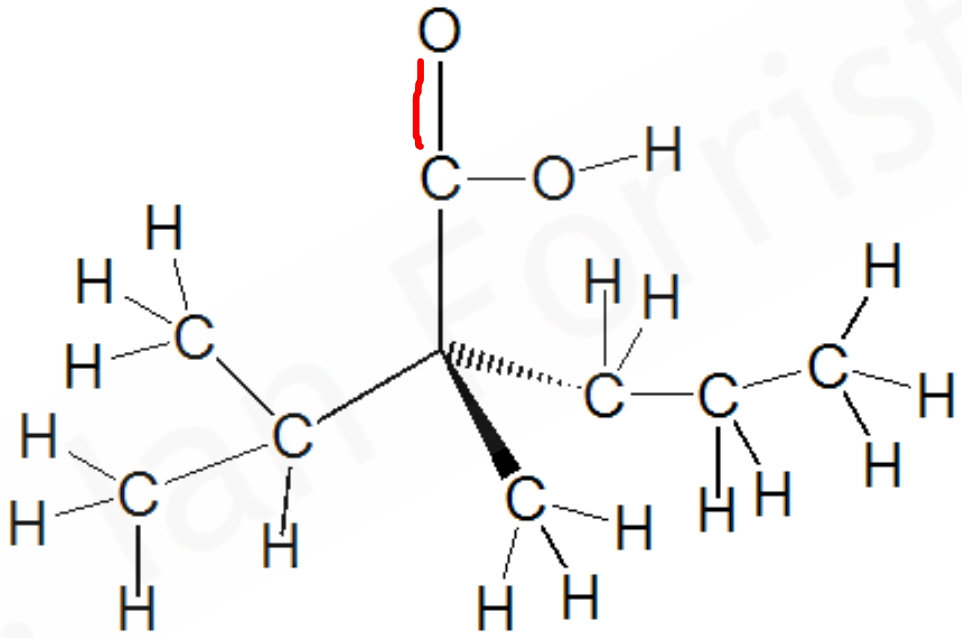
Four different groups attached to carbon → **CHIRAL**



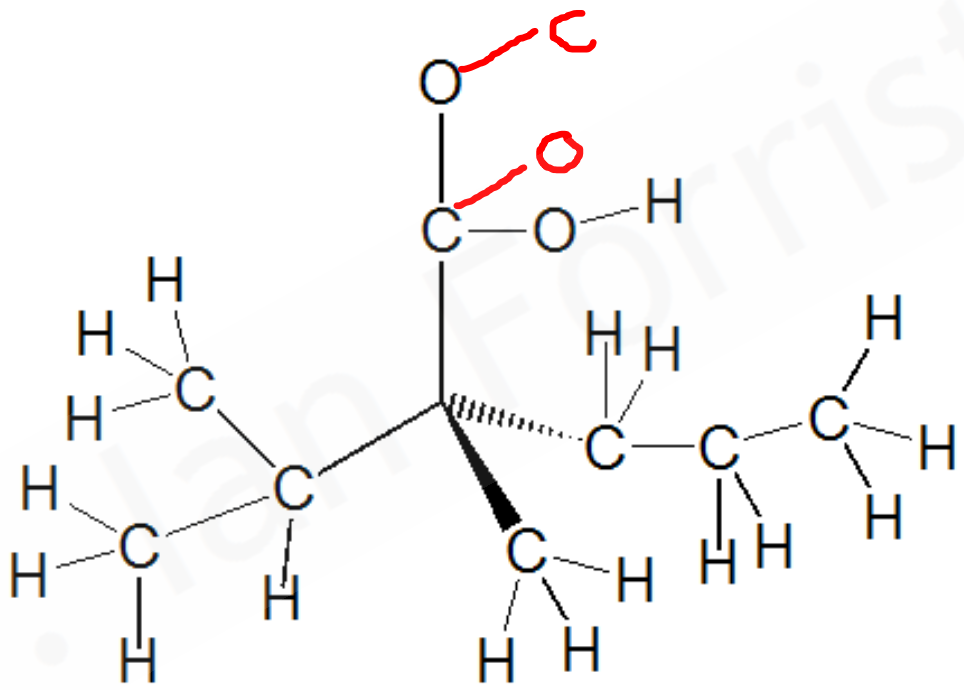
What is the configuration (**R** or **S**) of the following molecule?



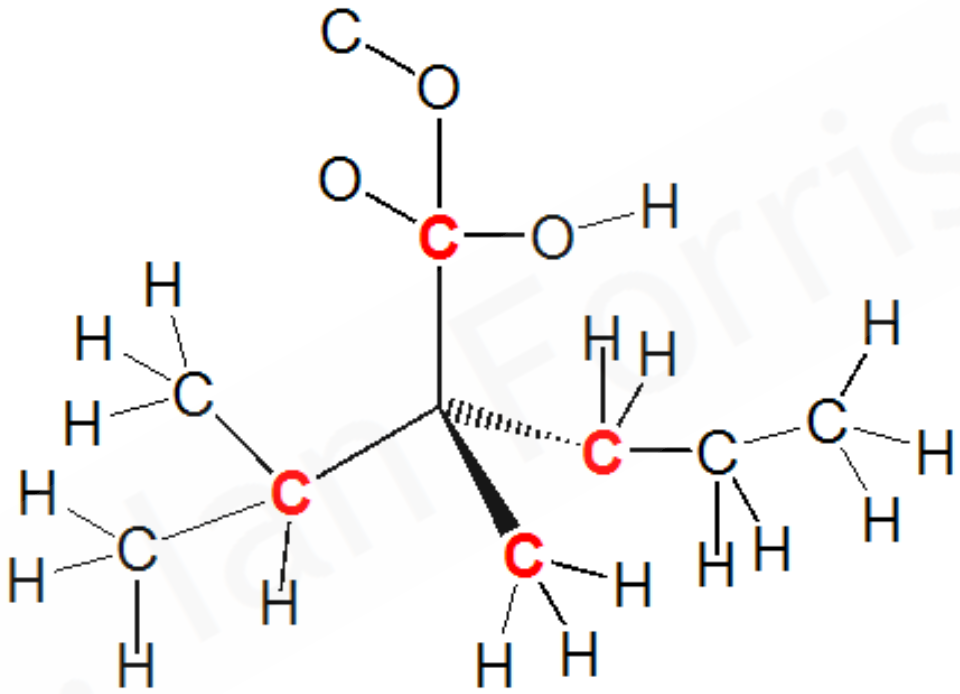
1) Draw the structure in full



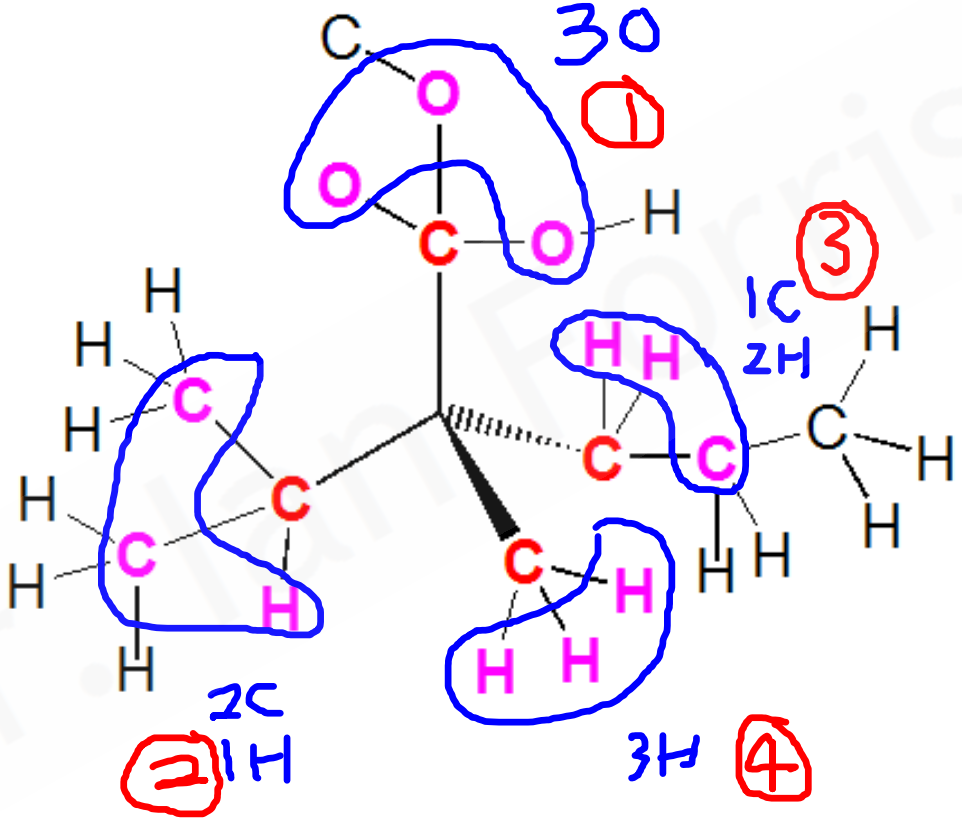
2) Convert double bonds into single bond equivalents

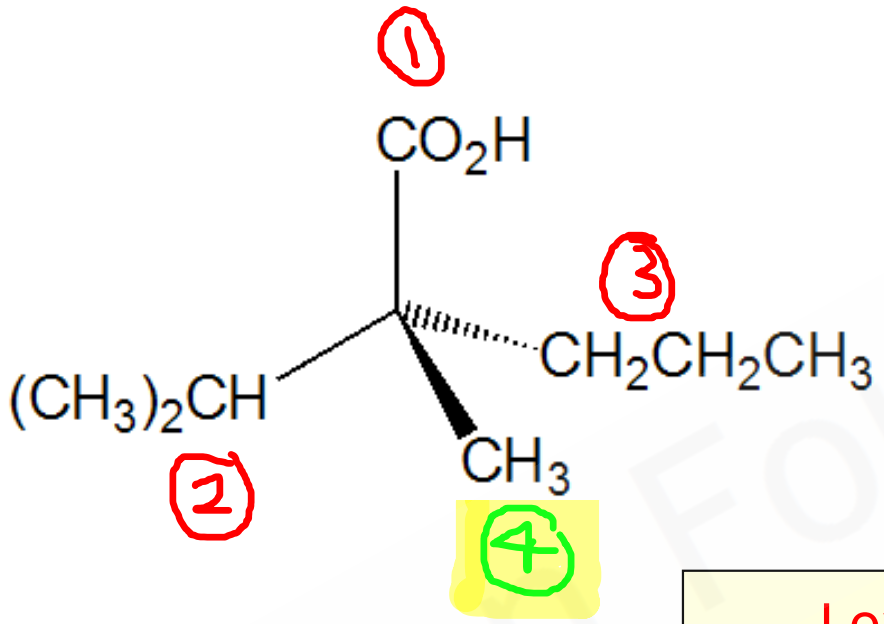


3) Priority of first atom is the same



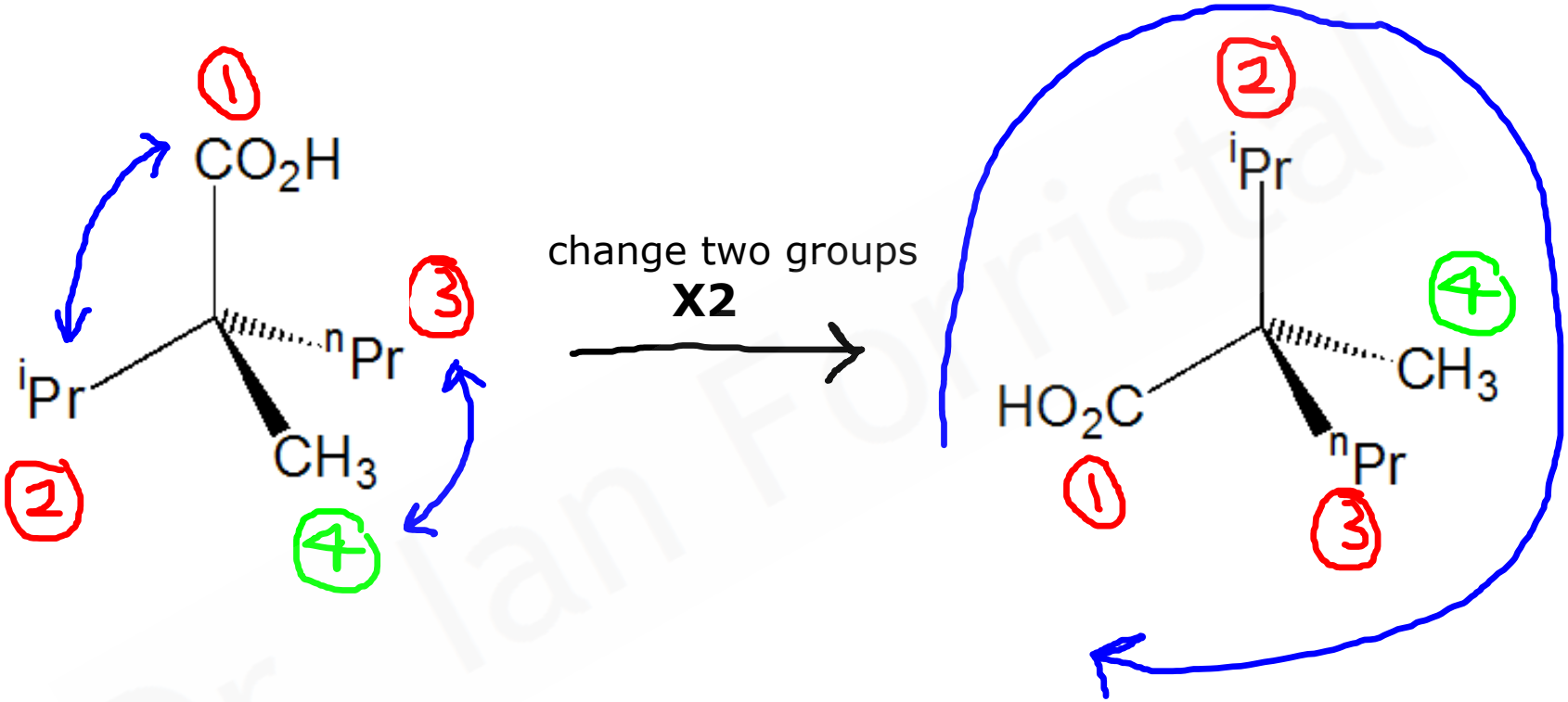
4) Priority of second atoms is different





Lowest priority group **NOT** orientated **away from viewer**

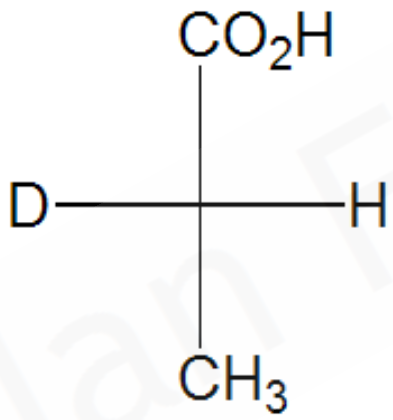
5) Rotate molecule so lowest priority group is away from viewer



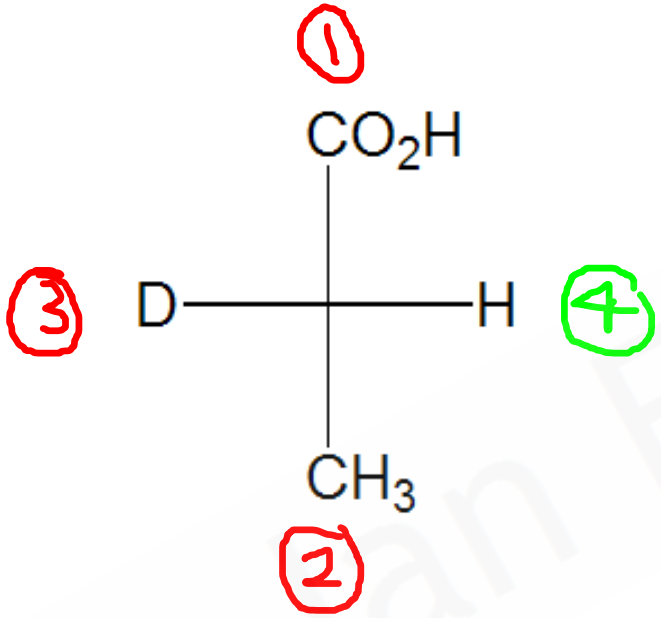
R

Lowest priority group orientated **away from viewer**

What is the configuration (**R** or **S**) of the following molecule?

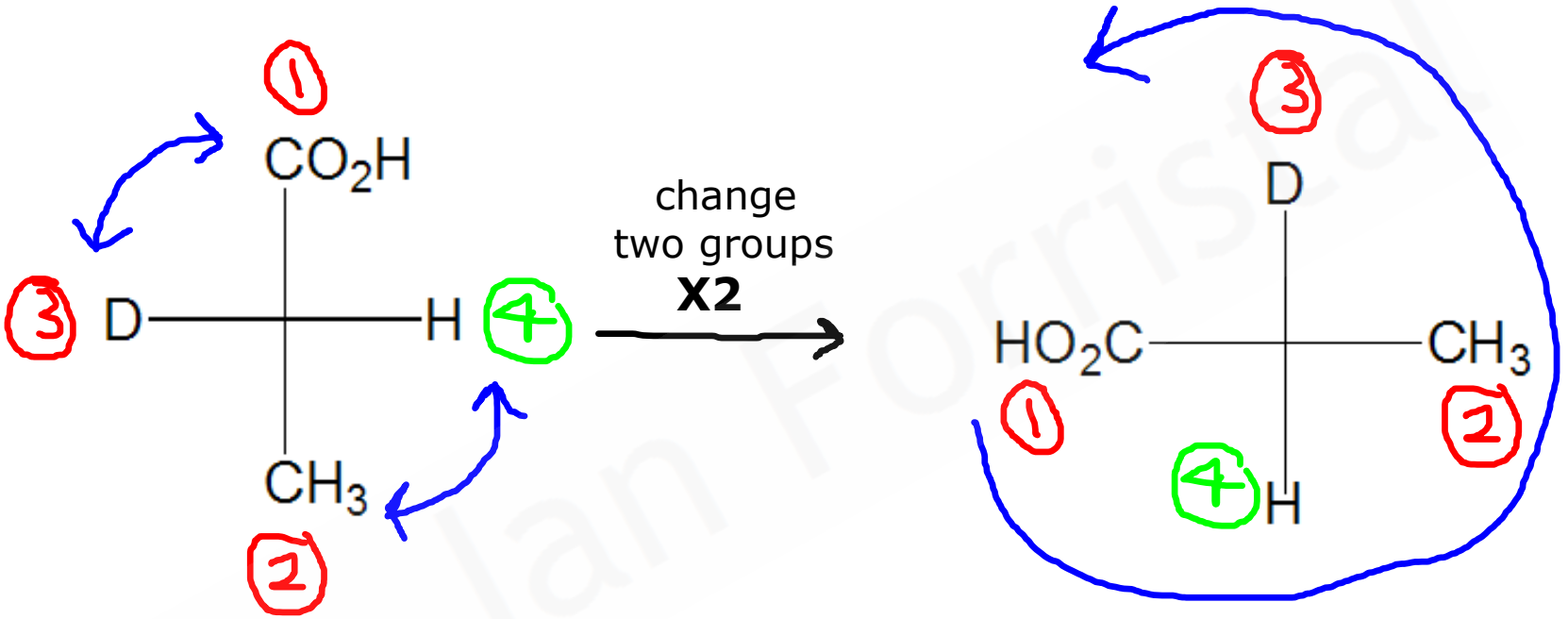


1) Assign the priority of the four different groups



Lowest priority group **NOT** orientated **away from viewer**

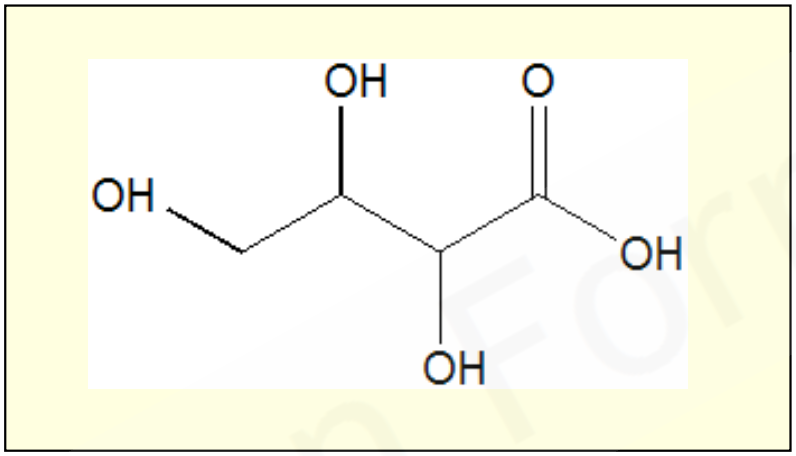
2) Rotate molecule so lowest priority group is away from viewer



S

Lowest priority group orientated **away from viewer**

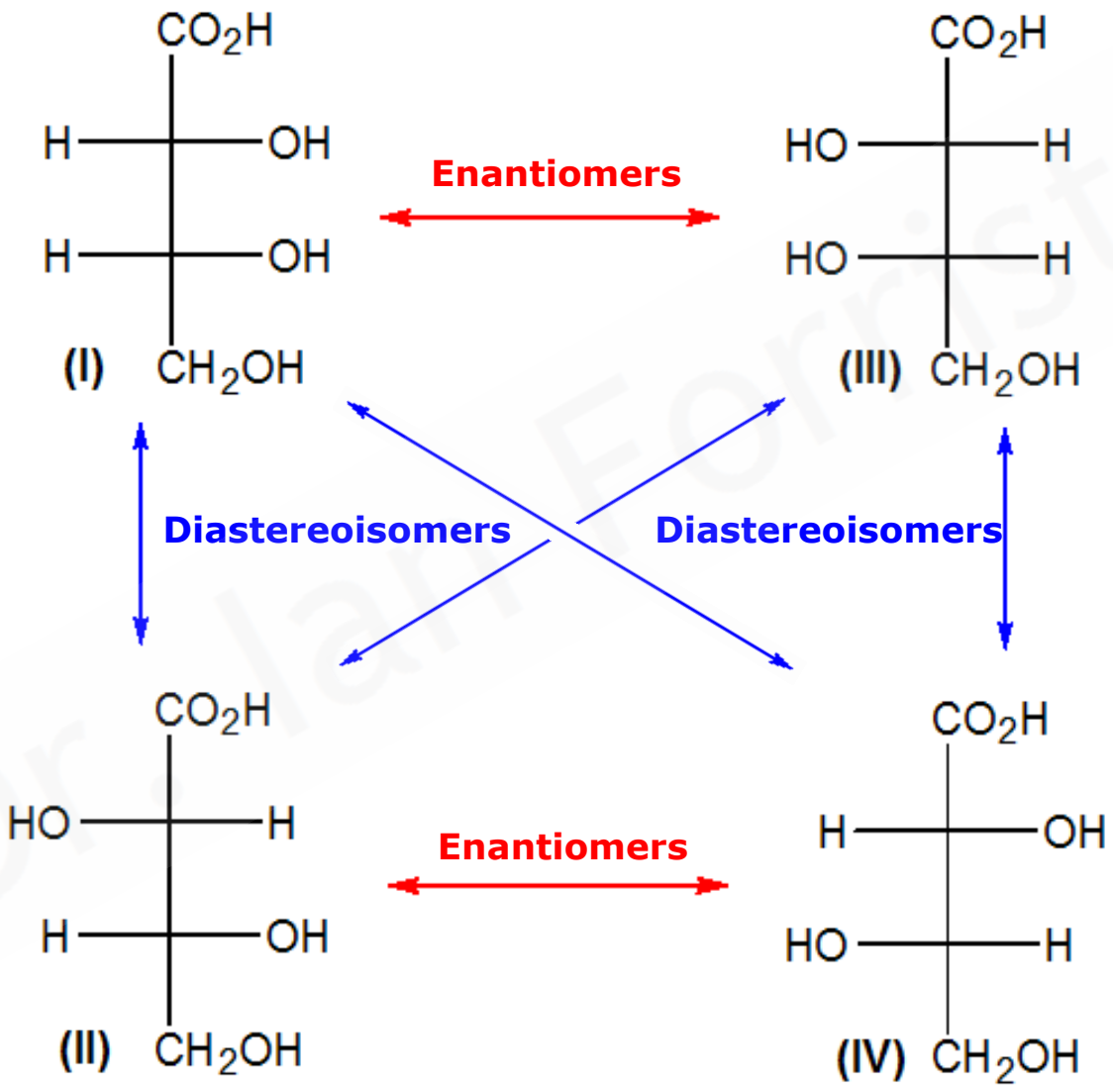
$HOCH_2CH(OH)CH(OH)CO_2H$



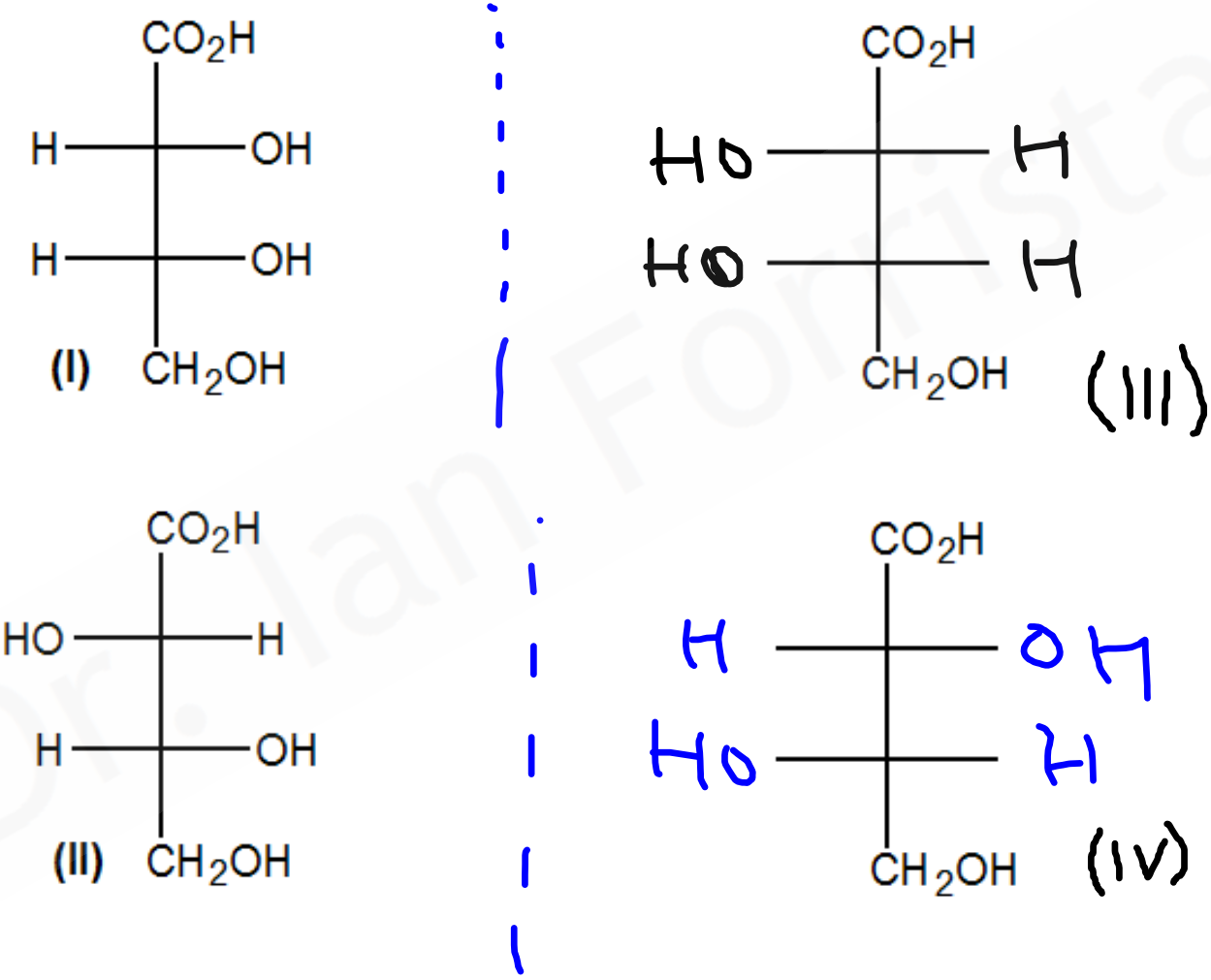
Number of Stereoisomers = $2^n = 2^2 = 4$

n = number of chiral centers

The four stereoisomers of $HOCH_2CH(OH)CH(OH)CO_2H$



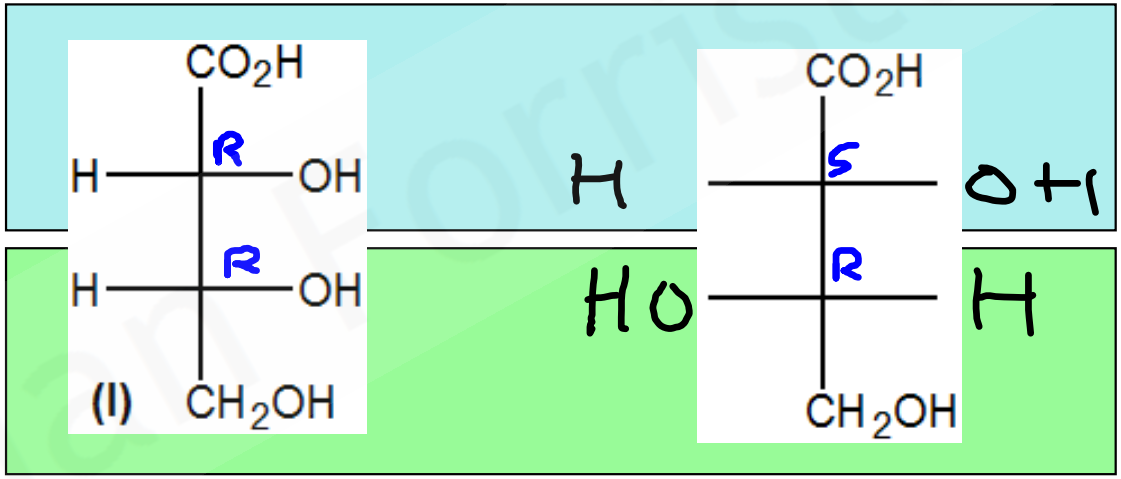
How to draw the **Enantiomer** (reflect in a mirror)



How to draw the **Diastereoisomer**

One chiral center DIFFERENT

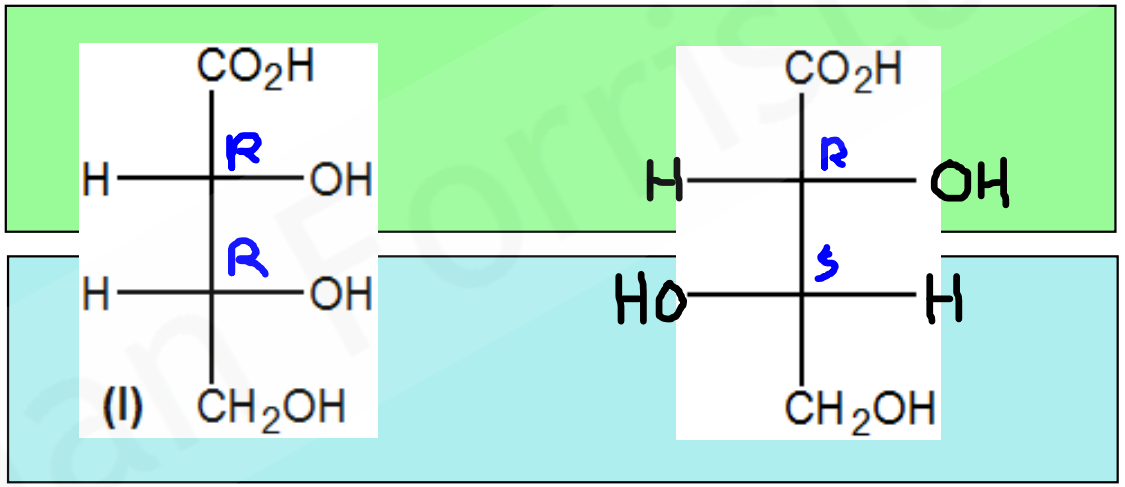
One chiral center the SAME



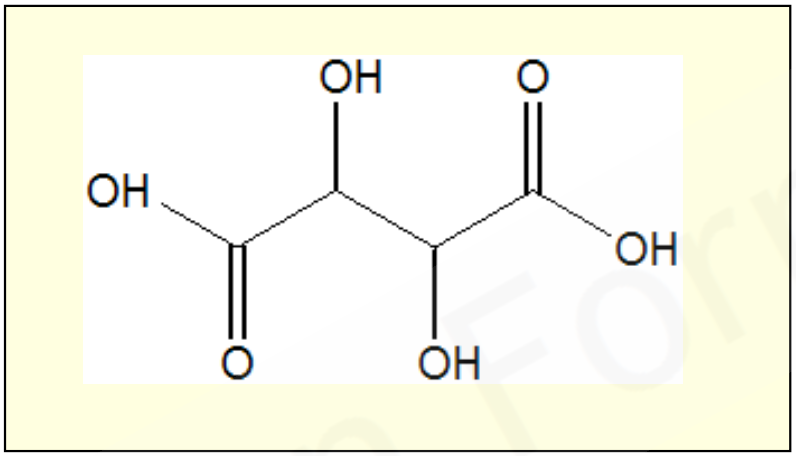
How to draw the **Diastereoisomer**

One chiral center the SAME

One chiral center DIFFERENT



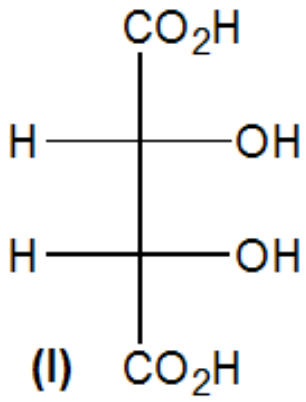
$HO_2CCH_2CH(OH)CH(OH)CO_2H$ (Tartaric acid)



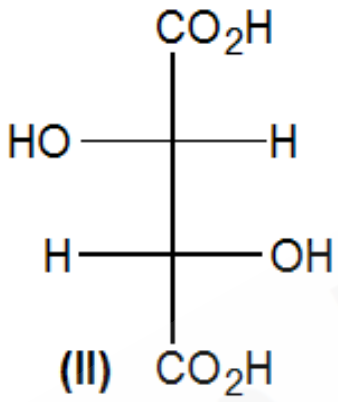
Number of Stereoisomers = $2^n = 2^2 = 4$

n = number of chiral centers

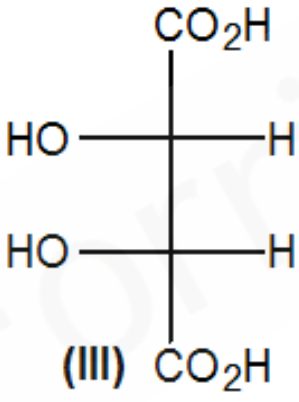
The four stereoisomers of $HO_2CCH_2CH(OH)CH(OH)CO_2H$



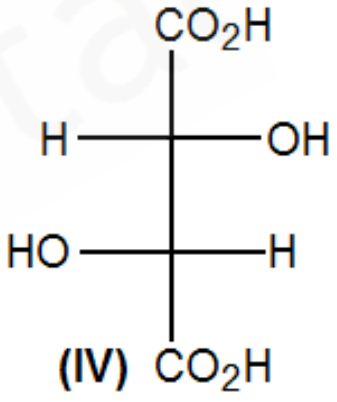
(I)



(II)

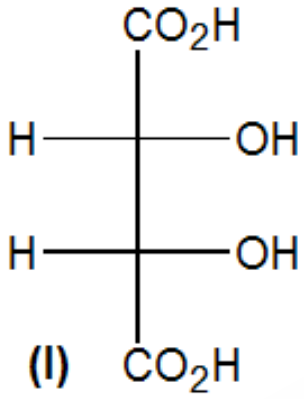


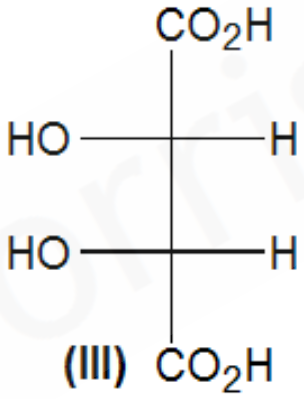
(III)

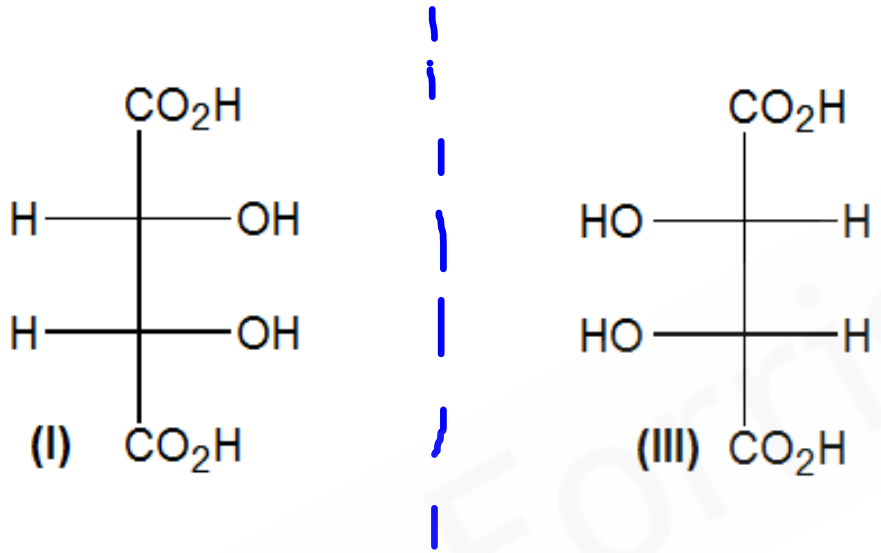


(IV)

Are these two stereoisomers **Enantiomers** ?



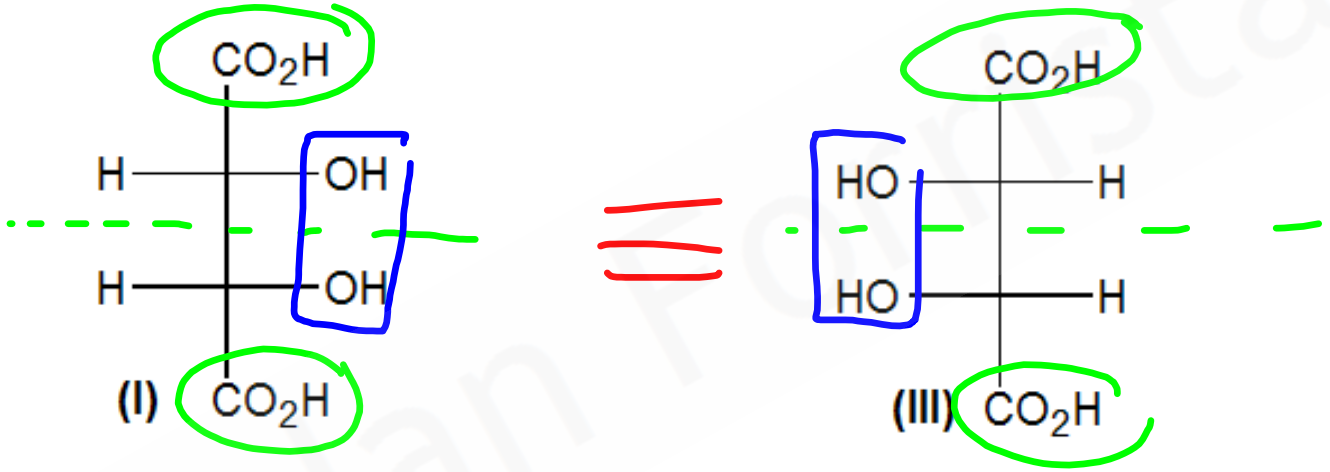




Mirror Images are Superposable

They are NOT enantiomers

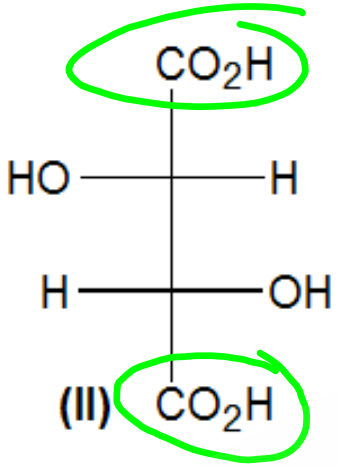
Both contain an **internal plane of symmetry** and so are known as **MESO** compounds

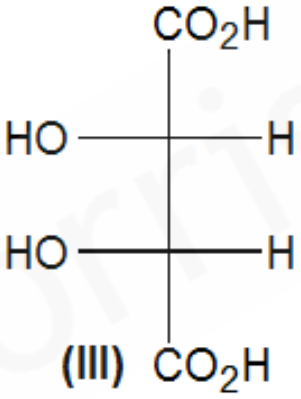


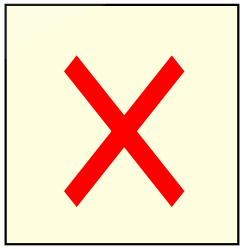
(I) & (II) are INDENTICAL

Use your models to verify that they are identical

Are these two stereoisomers **Enantiomers** ?

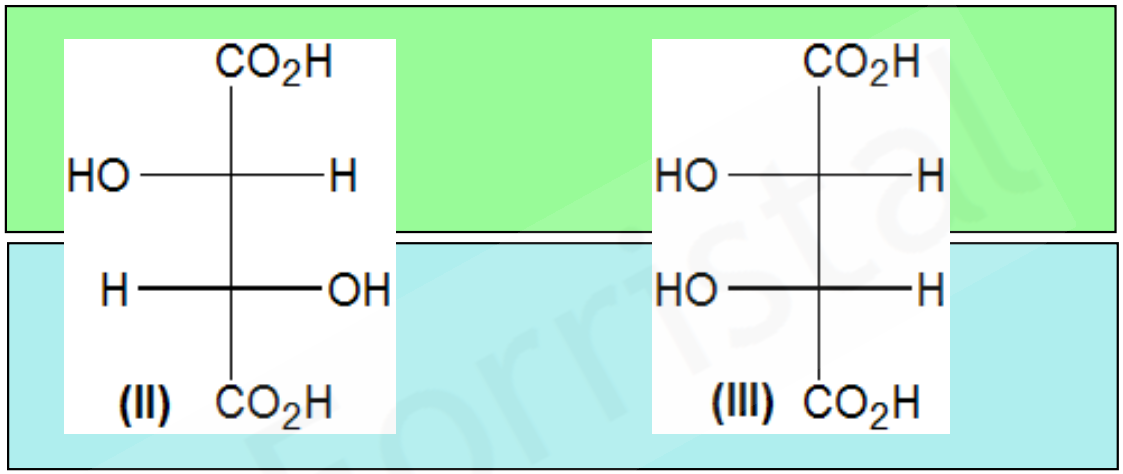






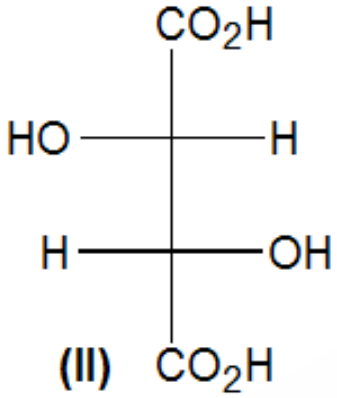
One chiral center the SAME

One chiral center DIFFERENT

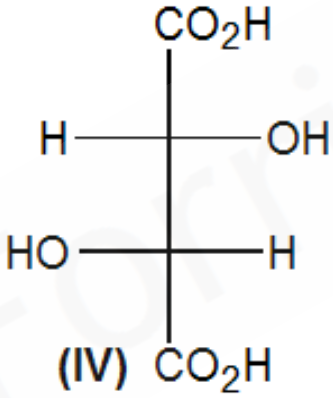


(II) & (III) are DIASTEREOISOMERS

Are these two stereoisomers **Enantiomers** ?



(II)



(IV)

Use your models to confirm this