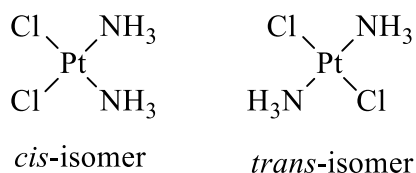


## CHEMISTRY 1B (CHEM1102) - June 2013

2013-J-2

•	$[\text{CrCl}_2(\text{NH}_3)_4]^n$	$[\text{Fe}(\text{ox})_3]^n$	$[\text{ZnCl}_2(\text{NH}_3)_2]^n$
	+III	+III	+II
	3	5	10
	3	5	0
	1+	-3	0
	Yes	Yes	No

The Pt compound has square planar geometry and hence 2 isomers, where the Cl groups are either opposite each other (*trans*) or next to each other (*cis*). The Zn compound has tetrahedral geometry and hence only one structure exists



2013-J-3

- 5.1  
 $7 \times 10^{-5} : 1$

2013-J-4

- Atomic radius decreases across a period as the number of protons and electrons is increasing. As the electrons are all be added to the same shell, they do not shield each other from the increasing nuclear charge and consequently  $Z_{\text{eff}}$  increases and the electrons are pulled closer to the nucleus.

Atomic radii increase going down a group. As  $n$  increases, the size of the orbitals increases and the electrons in these orbitals are shielded from the nuclear charge by electrons with smaller  $n$ . They are thus less tightly held and further from the nucleus.

- All  $\text{HClO}_n$  acids have the structure  $\text{HOClO}_{n-1}$ . As the number of oxygens increases, more electron density is drawn away from the O–H bond and weakens it. The weaker the O–H bond, the stronger the acid, so the order is  $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$ .  
In binary acids such as  $\text{H}_2\text{S}$  and  $\text{H}_2\text{Se}$ , the H–Se bonds is longer than the H–S bonds as Se is larger than S. The H–Se bond is therefore weaker than the H–S bond and  $\text{H}_2\text{Se}$  is thus a stronger acid than  $\text{H}_2\text{S}$ . The order is therefore  $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$ .

2013-J-5

- 4.74  
4.65  
 $9.94 \times 10^{-11} \text{ M}$

2013-J-6

- MX  
8

2013-J-7

- 1: solid                      2: liquid  
3: gas                        4: supercritical fluid  
sublimation                deposition  
triple point                critical point

Solid water (ice) is less dense than liquid water. Ice therefore floats and rivers, lakes and oceans freeze from the top down. As just the surface of a body of water freezes, the liquid environment for the life-forms below the surface is preserved.

It can be considered as either a very dense gas or as a rarefied liquid with physical properties (e.g. density, viscosity, diffusion coefficients) between those of liquids and gases. It is a good solvent.

2013-J-8

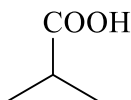
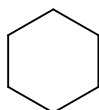
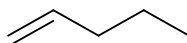
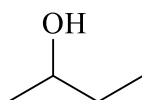
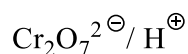
$$\text{Rate} = k[\text{NO}][\text{NO}_2] \quad k = 2.1 \text{ M}^{-1} \text{ s}^{-1}$$

$$39 \text{ kJ mol}^{-1}$$

$$k = 2.5 \times 10^{-4} \text{ s}^{-1}$$

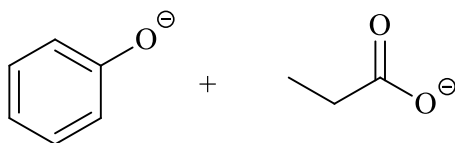
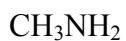
2013-J-9

•



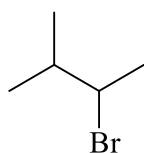
2013-J-9 (cont)

•

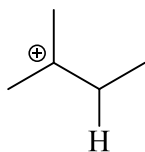


2013-J-10

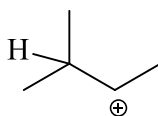
•



Two possible intermediate carbocations can be formed. The tertiary carbocation is more stable and leads to the major product B, whilst the secondary carbocation is less stable and leads to the minor product C.



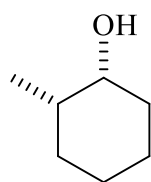
tertiary carbocation  
(more stable)



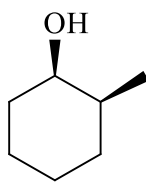
secondary carbocation  
(less stable)

2013-J-11

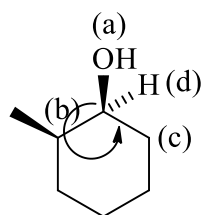
•



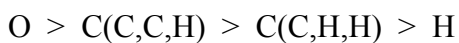
or



0



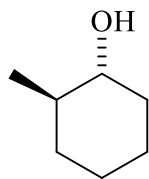
The order of priority is:



With lowest priority (d) at back, the order of the groups goes anticlockwise as shown. Therefore the stereochemistry is (S).

The molecule is still chiral as the molecule still contains a stereogenic centre.

2013-J-11 (cont)

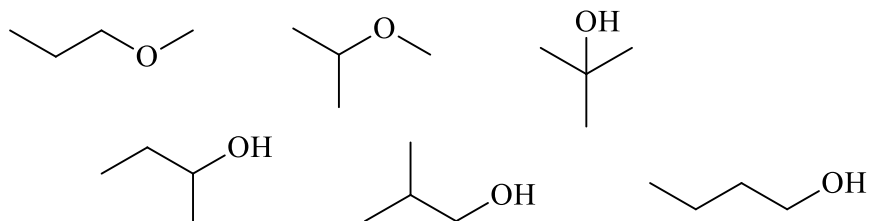


The approximate ratio will be 1:1 as attack by hydride ion is equally likely from above or below the ring.

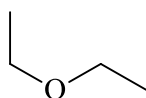
(There may be a slight excess of **F** as the methyl group may slightly inhibit attack from above by steric interference.)

2013-J-12

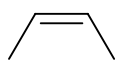
- any of the following



There is an infinite number of conformational isomers. Only one is given



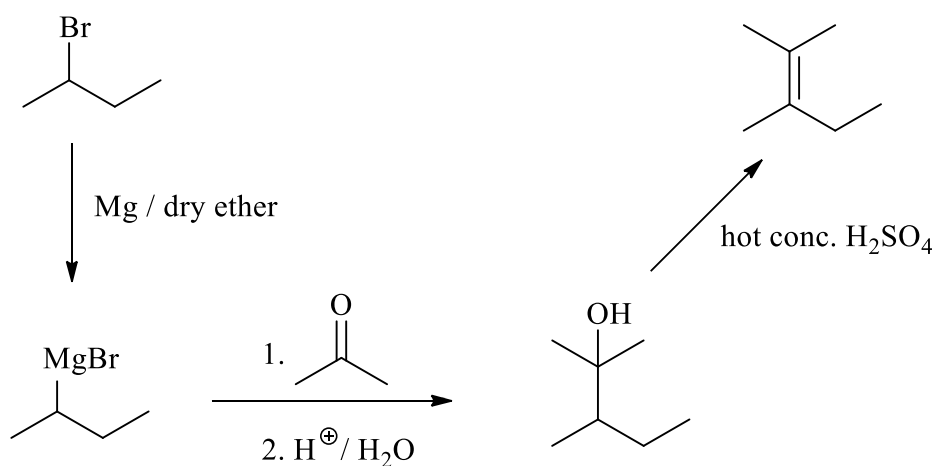
As there are no rings, double bonds or stereogenic centres, the molecule does not have any diastereomers or enantiomers.



**K** is (*E*)-2-butene

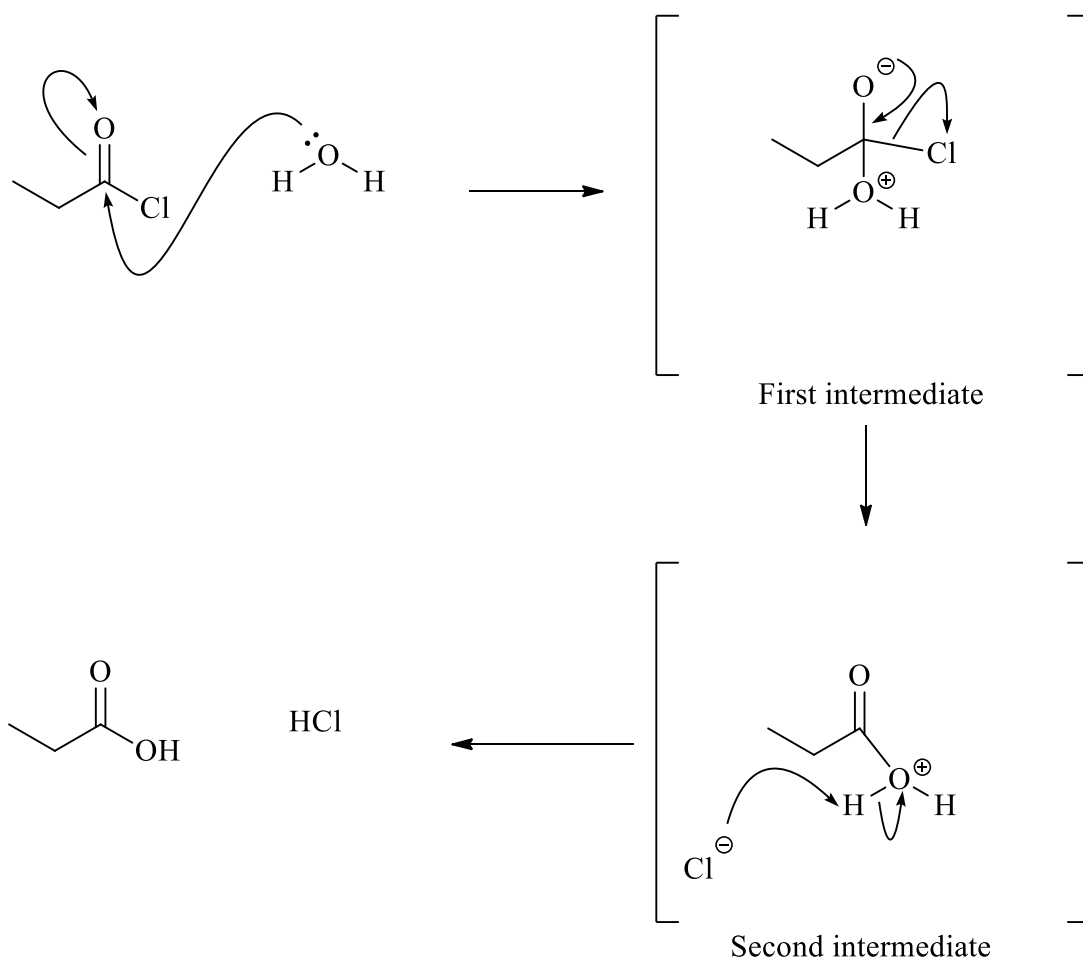
2013-J-13

- 



2013-J-14

•



$sp^2$

$sp^3$