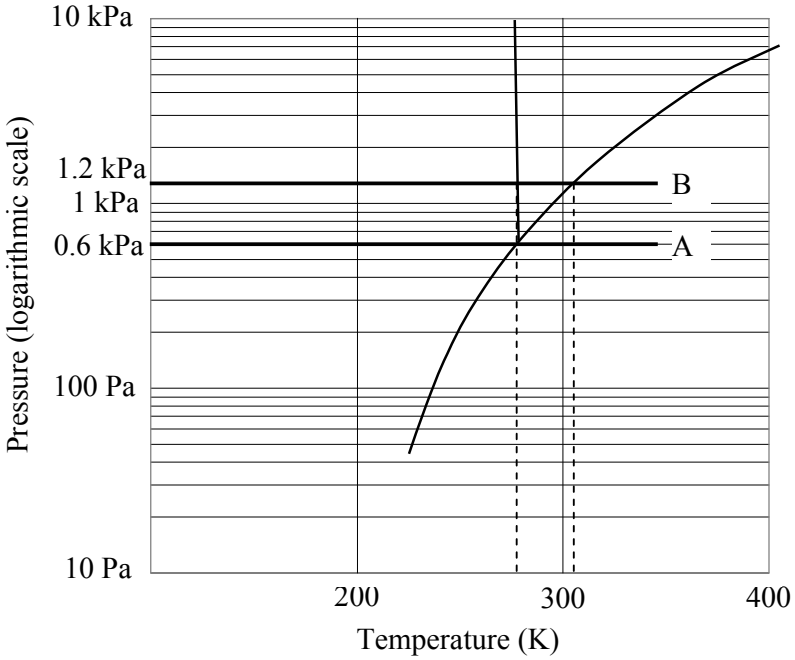
FUNDAMENTALS OF CHEMISTRY 1B (CHEM1002) - November 2010

2010-N-2

- 

  It sublimes. Line A at 0.6 kPa (*i.e.* 600 Pa) crosses the solid/gas equilibrium line just below the triple point.

  Line B on the phase diagram. Water is liquid in the range approx. 272 - 305 K.

2010-N-3

- There are 4 Fe atoms in the unit cell, 1 in the centre and ¼ in the centre of each edge. $1 + (12 \times ¼) = 4$ Fe atoms per unit cell.
  There are 4 O atoms in the unit cell, ⅛ at each corner and ½ in the centre of each face. $(8 \times ⅛) + (6 \times ½) = 4$ O atoms per unit cell. Ratio of Fe:O = 4:4. Therefore FeO.
  Coordination number of each ion is 6.

  $Fe^{2+} : Fe^{3+} = 1 : 2$

  Fe^{2+} has 6 *d* electrons, 4 are unpaired as shown below.

↑↓	↑	↑	↑	↑

  Fe^{3+} has 5 unpaired *d* electrons arranged in the 5 available *d* orbitals as shown below.

↑	↑	↑	↑	↑

2010-N-4

- 0.1 M to 0.01 M

  No. Buffers contain a weak acid and its conjugate base. HCl is a strong acid and its conjugate base is Cl^-, a very weak base. Any added H^+ will decrease the pH as it doesn't react with the Cl^-. Any added OH^- will increase the pH as it reacts with the H^+, not the weak acid as happens in the case of a buffer.

  2.4

2010-N-5

- 0.01 M
  3×10^{-17} M
  100 %

2010-N-6

- 2.7
  100 %
  3 hours

2010-N-7

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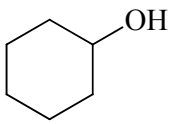
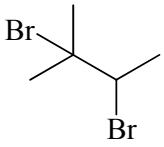
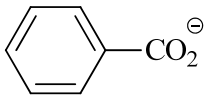


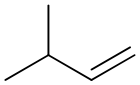


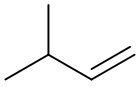
2-methyl-2-butene



+ CH_3OH

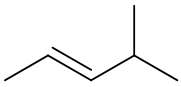
2,4-dimethylpentan-2-ol NO REACTION

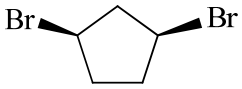


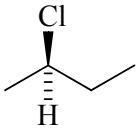


2010-N-8

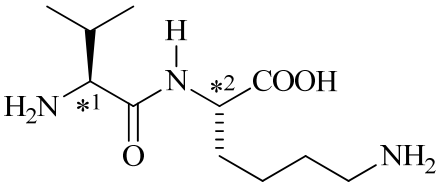
- nucleophile electrophile tertiary (3°)
  nucleophile electrophile quaternary (4°)

- 





2010-N-9

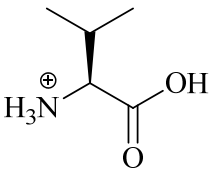
- 

Priorities at *1: $-NH_2$ > $-CONHR$ > $-CH(CH_3)_2$ > $-H$

With H at back these groups go anticlockwise. Therefore (*S*)- configuration about *1.

Priorities at *2: $-NHCOR$ > $-COOH$ > $-(CH_2)_4NH_2$ > $-H$

With H at front these groups go clockwise. Therefore, with H at back, they would go anticlockwise. Therefore (*S*)- configuration about *2.



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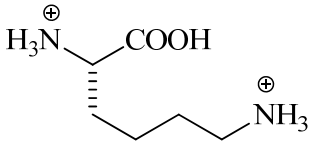

2010-N-10

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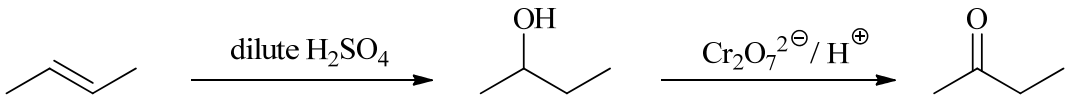

The product absorbs strongly in the 1650-1800 cm^{-1} region.
The intermediate alcohol absorbs strongly in the 3000-3300 cm^{-1} region.
The starting material does not absorb strongly in either of these regions.

The starting material is symmetrical and has only 2 resonances whilst the product has 4 resonances.

2010-N-11

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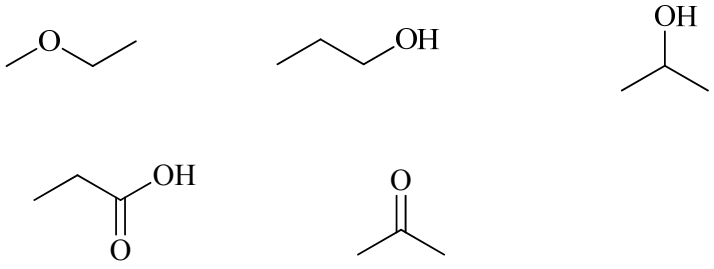

propionic acid
(or propanoic acid)

acetone

Add a solution of sodium hydrogencarbonate. The propionic acid will evolve lots of CO_2 bubbles. There will be no reaction with the acetone.