CHEMISTRY 1B (CHEM1102) - November 2010

2010-N-2

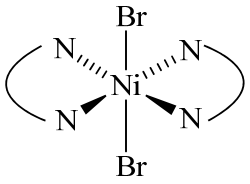
- In Group 17 oxyacids, electron density is drawn away from the O atom as the electronegativity of the halogen increases. This in turn draws electron density away from the O–H bond and weakens it. The weaker the O–H bond, the stronger the acid. Cl is more electronegative than Br so HOCl is stronger acid than HOBr.

  In binary acids such as HBr and HCl, the H–Br bond is longer than the H–Cl bond as Br is larger than Cl. The H–Br bond is therefore weaker than the H–Cl bond and HBr is thus a stronger acid than HCl.

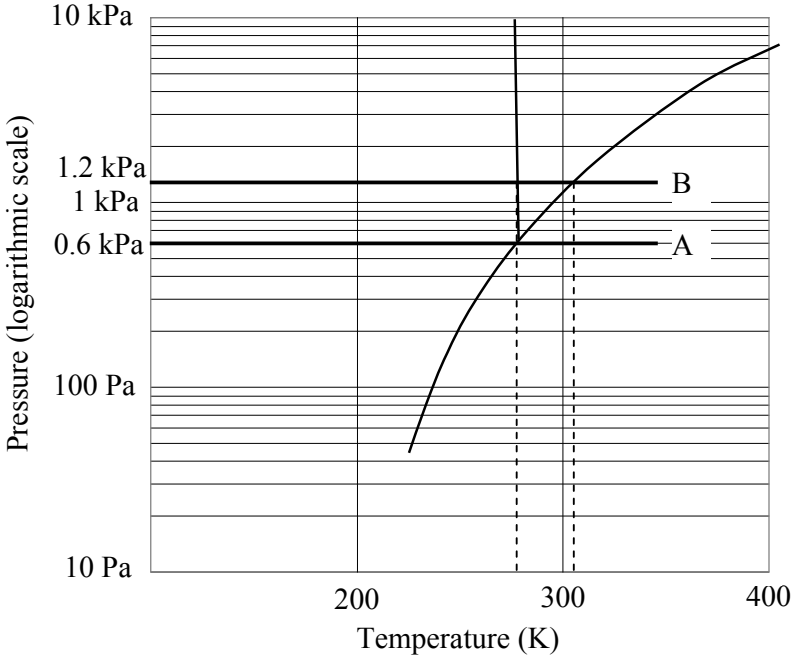
Ti^{2+}, d^2	↑	↑				is paramagnetic
Ti^{3+}, d^1	↑					is paramagnetic
Ti^{4+}, d^0						is diamagnetic

- *trans*-dibromidobis(ethylenediamine)nickel(II) or
  trans-dibromidobis(ethane-1,2-diamine)nickel(II)

  It is not chiral as it is superimposable on (*i.e.* identical to) its mirror image.



2010-N-3

- 

  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-4

+II	+II	+III
6	4	6
8	8	5
octahedral	square planar	octahedral
N	Cl, N	N, O

2010-N-5

- The high ionic charge on Co^{3+} polarises the O–H bond in the aqua ligand. This weakens the O–H bond causing the complex to be acidic in aqueous solution.

  3.35

  9.35

  47 mL of solution A and 953 mL of solution B

2010-N-6

- 8.1×10^{-3} M

2010-N-7

- Rate = $k[H_2SeO_3][I^-]^3[H^+]^2$

  $k = 1.00 \times 10^6\ M^{-5}\ s^{-1}$

2010-N-8

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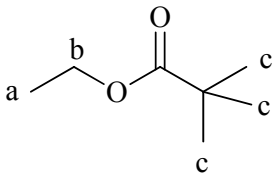
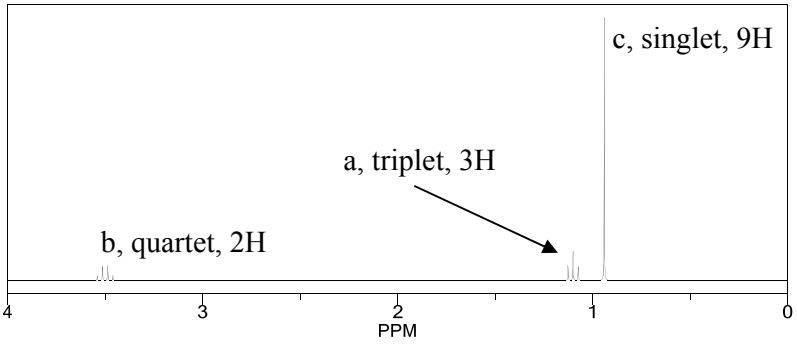
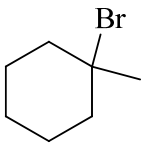


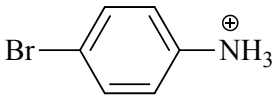


2010-N-9

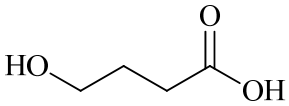
- 

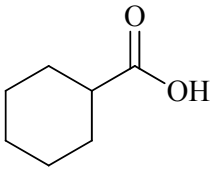
1. OH^-
2. CH_3Br

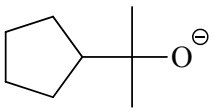
1. $LiAlH_4$/dry ether
2. H^+/H_2O



$SOCl_2$







2010-N-10

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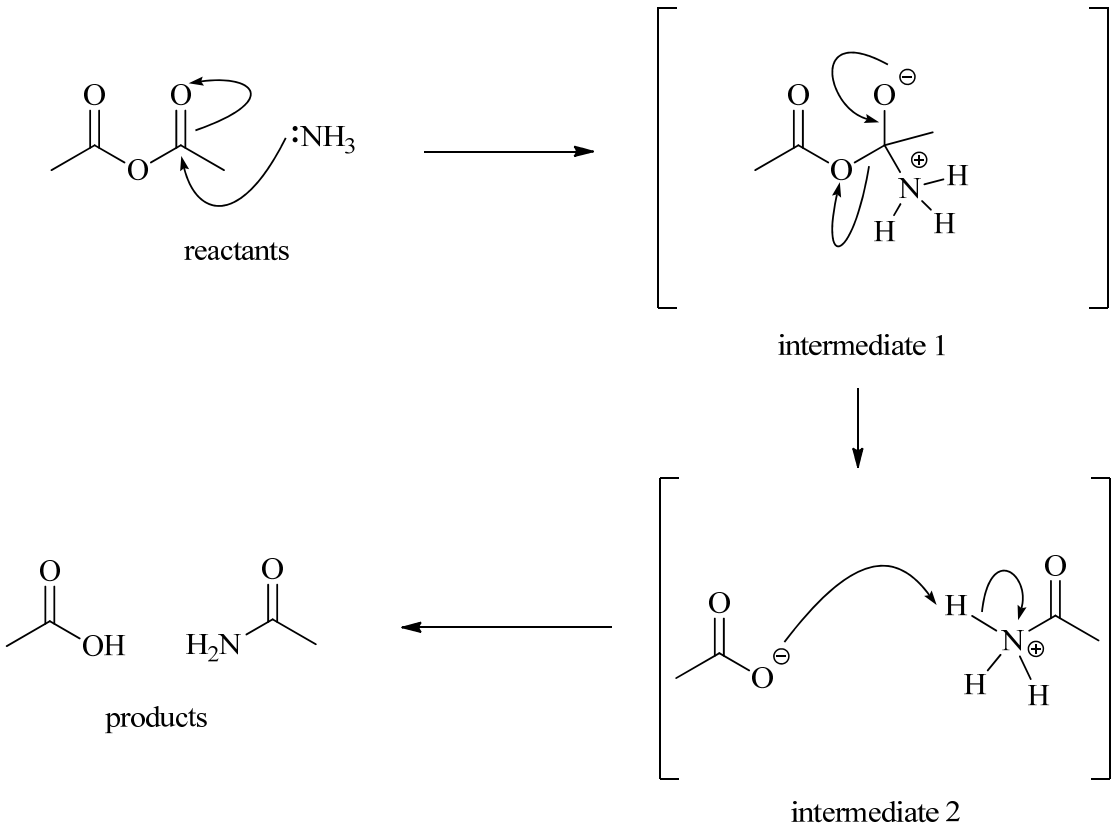


2010-N-11

• Using the high resolution mass spectra:

A ($C_4H_8O_2$) has MW = 4 × 12.0000 + 8 × 1.0078 + 2 × 15.9949 = 88.0522

B ($C_5H_{12}O$) has MW = 5 × 12.0000 + 12 × 1.0078 + 15.9949 = 88.0885

C ($C_4H_{12}N_2$) has MW = 4 × 12.0000 + 12 × 1.0078 + 2 × 14.0031 = 88.0998

The unknown compound has a high resolution molecular ion peak of 88.0888 which is very close to the expected value for compound **B**.

Using elemental analysis, the unknown compound has C:H ratio of
68.13/12.0107 : 13.72/1.0079 = 5.672 : 13.61 ≈ 1 : 2.4

A ($C_4H_8O_2$) has C:H = 4 : 8 = 1 : 2

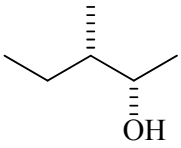
B ($C_5H_{12}O$) has C:H = 5 : 12 = 1 : 2.4

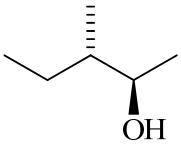
C ($C_4H_{12}N_2$) has C:H = 4 : 12 = 1 : 3

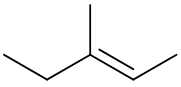
Therefore the unknown is compound **B**.

2010-N-12

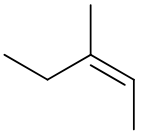
- Both stereogenic centres have (*R*)-configuration.







or



(*E*)-3-methyl-2-pentene (*Z*)-3-methyl-2-pentene

Neither compound has a stereogenic centre, so neither is optically active.

2010-N-13

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