

CHEMISTRY 1B (CHEM1902/1904) - November 2014

NB These answers have not been checked

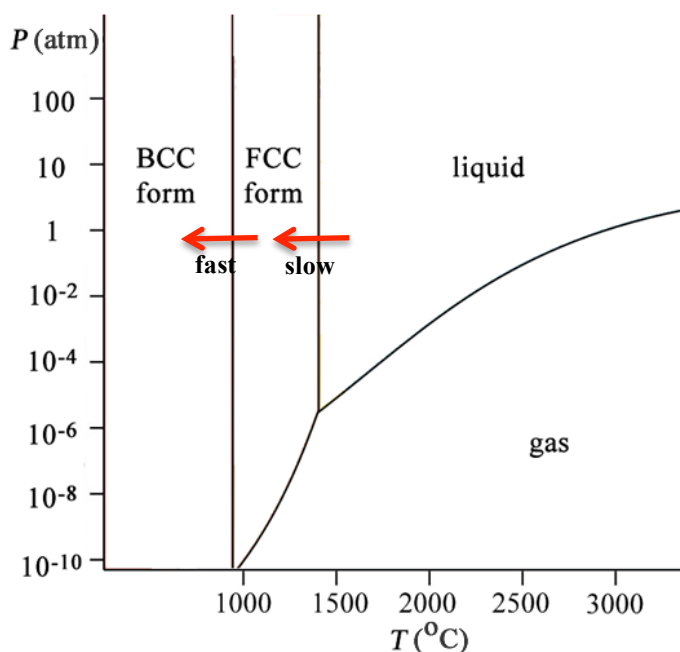
2014-N-2

- BN
+III (or +3)

The B-N bonds are partially ionic. Also, a protective layer of B_2O_3 forms on the surface.

2014-N-3

- BCC form
See below



Fast cooling to room temperature does not allow the atoms to re-arrange; they are stuck in the FCC form as considerable re-arrangement is needed to turn this in the BCC form.

The line between BCC and FCC has a negative slope (\searrow). If the system is on the line and the pressure is increased, the system moves into the FCC region.

2014-N-4

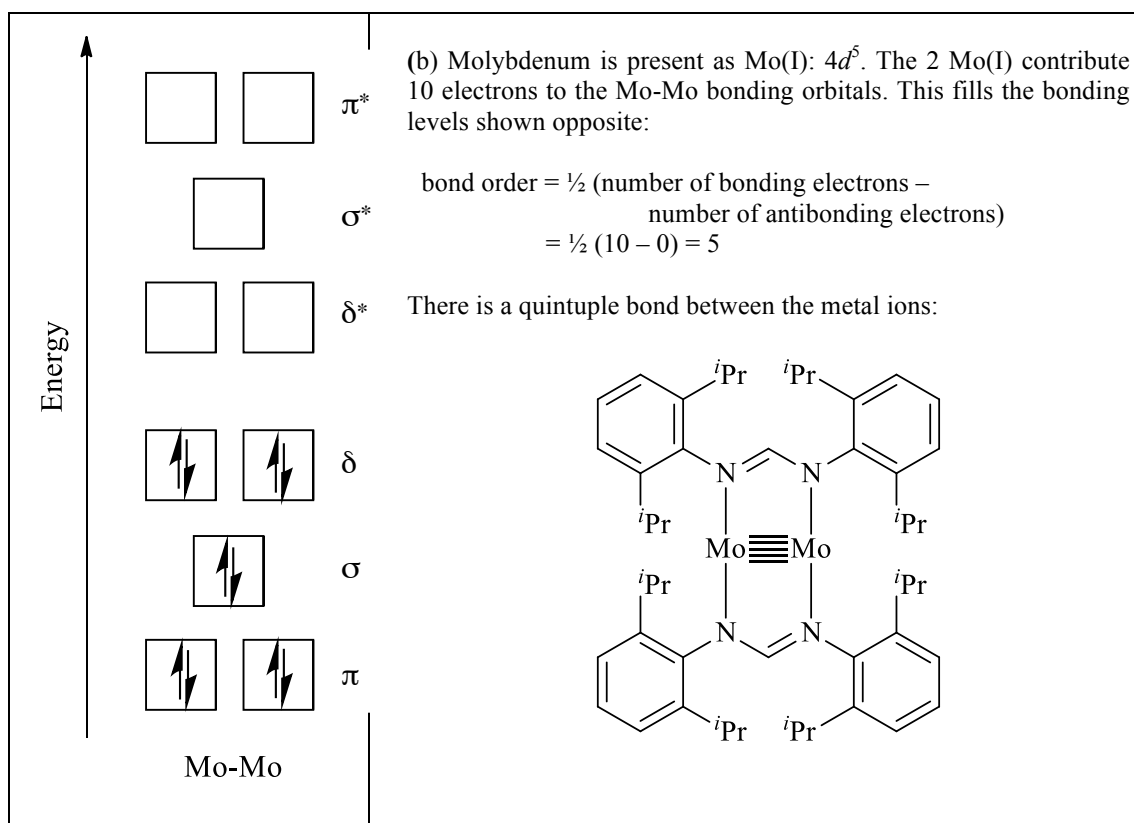
- bis(aminidato)dimolybdenum(I)

See overleaf.

Bonding electrons have been removed: the bond order drops to 4 and the weaker bond is longer.

There will be 2 unpaired electrons.

2014-N-4 (cont.)



2014-N-5

- 4.73
11.64
650 mL of solution A and 350 mL of solution B

2014-N-6

- $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}(\text{s}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{C}_2\text{O}_4^{2-}(\text{aq}) + \text{H}_2\text{O}(\text{l})$ $K_{\text{sp}} = [\text{Ca}^{2+}(\text{aq})][\text{C}_2\text{O}_4^{2-}(\text{aq})]$
 $4.8 \times 10^{-5} \text{ mol L}^{-1}$
 No effect
 $3.0 \times 10^{-8} \text{ M}$

2014-N-7

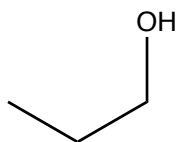
- $\text{rate} = k[\text{HI}]^2$
 $4.0 \times 10^{-2} \text{ mol}^{-1} \text{ L s}^{-1}$

2014-N-8

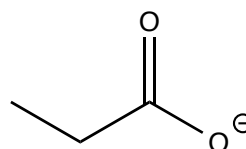
- propionic acid
 methyl propionate

F = CH_3OH

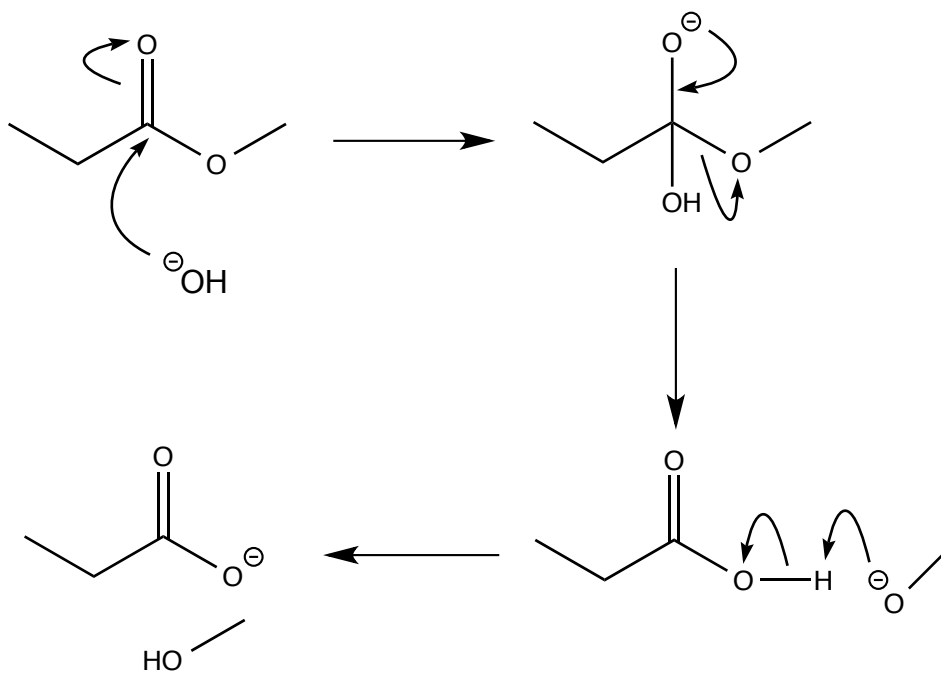
H =



J =

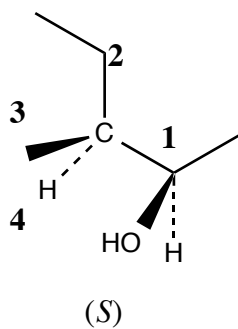
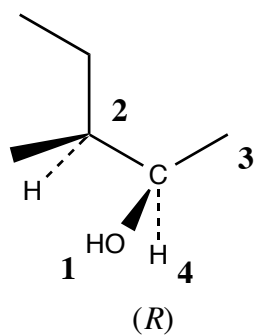


2014-N-8 (cont.)



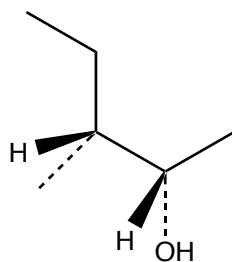
2014-N-9

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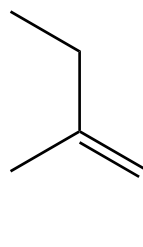


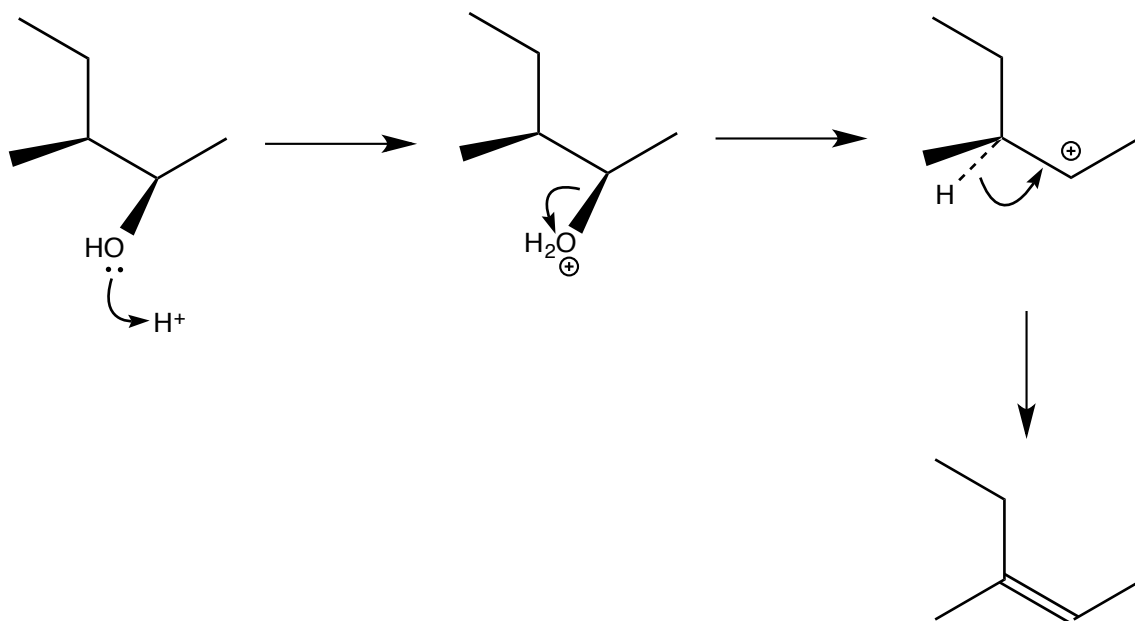
(Z)-3-methylpent-2-ene

Enantiomer of **A**:



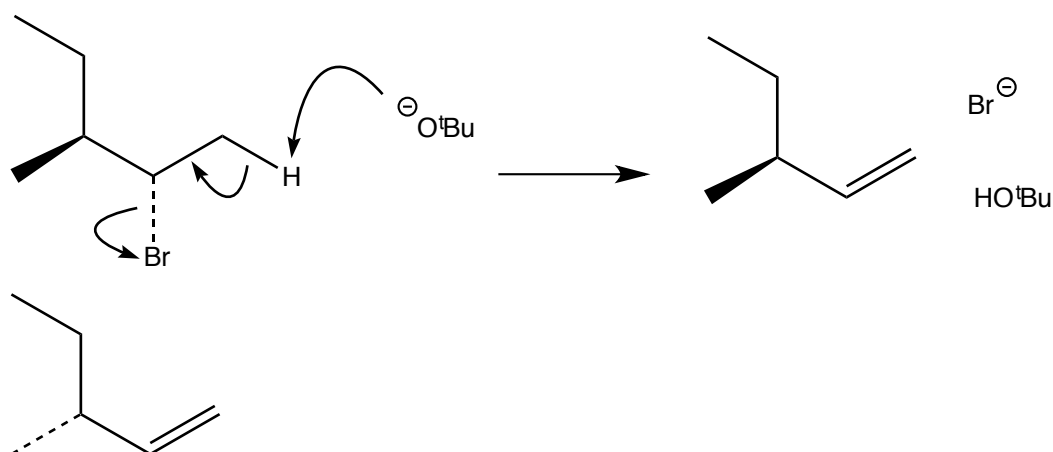
Diastereoisomers of **B**:





2014-N-10

- C is the less substituted alkene and, according to Zaitsev's rule, this is not favoured because it is less stable.

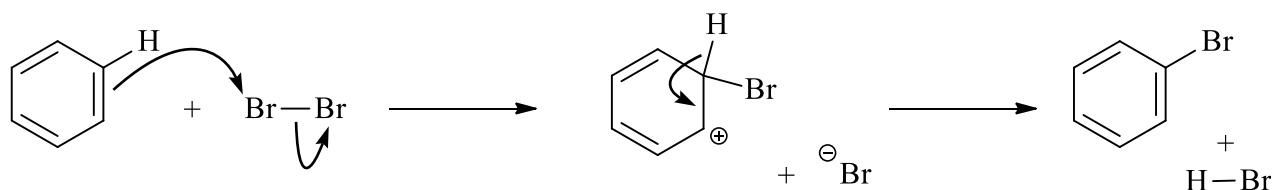


2014-N-11

- (i) Cyclic and planar, (ii) each atom in the ring must have be sp^2 hybridised so that it has a p -orbital perpendicular to the ring and (iii) the π system must have $4n+2$ electrons where n is any integer.
 The lone pair on N in pyridine is in an sp^2 hybrid, pointing out from the molecule and lying in the plane. It is not involved in the π system and is free to attach a proton. The N atom in pyrrole uses its 'lone pair' in the π system to add to the $4 e^-$ from the carbon atoms to give an aromatic electron count of 6. The 'lone pair' is in a p -orbital and is part of the π bonding. It is not available to attach a proton.
 Loss of a proton from C_5H_6 leads to C_5H_5^- . The 'lone pair' on the negatively charged C atom contributes to a total π electron count of 6 and the anion is aromatic and stabilised. This is not possible for cyclopentene.

2014-N-12

- See below.

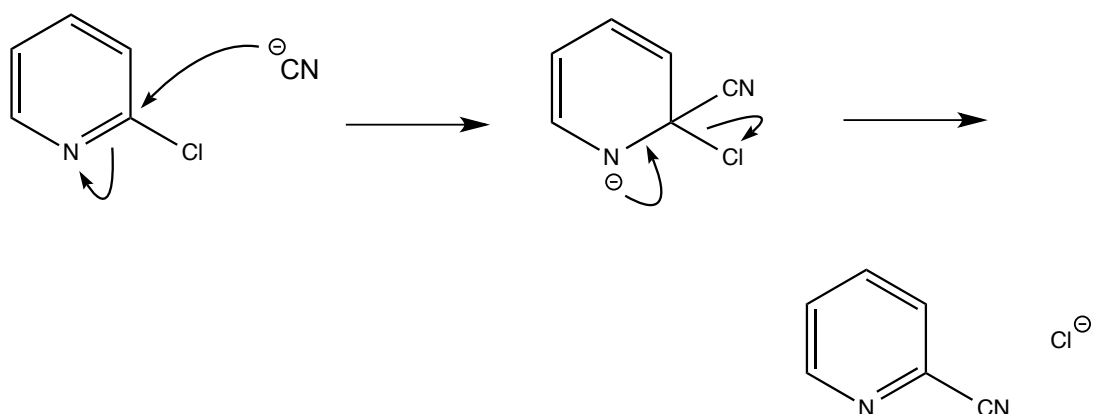


Substitution, Elimination, Aromatic

nucleophile: C=C in step (i). Br⁻ in step (ii)

electrophile: Br₂ in step (i). Carbocation in step (ii).

FeBr₃ is a catalyst. Br₂ attaches weakly to it causing the non-polar Br-Br bond to become polarised with a partial positive charge on one end. This makes it more electrophilic.



2014-N-13

- See below.

Conjugate base of S	Conjugate base of T	Conjugate base of U	Conjugate base of V

T will be a stronger acid. The conjugate base of T is more stable than that of S as the electronegative fluorine atoms will withdraw electron density from the negatively charged O atom.

U is a stronger acid than V because the conjugate base is more stable. Both are stabilised by resonance which acts to delocalise the negative charge over the electronegative O atoms present but the conjugate base of U has the charge delocalised over 3 O atoms rather than 2 O atoms.