FUNDAMENTALS OF CHEMISTRY 1B (CHEM1002) - November 2012

2012-N-2

- 2.75

  $C_6H_5COOH(aq)$, $H_2O(l)$

  10.98

  $NH_3(aq)$, $H_2O(l)$

2012-N-3

$C_6H_5COOH(aq) + NH_3(aq) \rightarrow C_6H_5CO_2^-(aq) + NH_4^+(aq)$

$$K = \frac{[C_6H_5CO_2^-][NH_4^+]}{[C_6H_5COOH][NH_3]}$$

1.1×10^5

$CH_3CO_2^-(aq)$, $NH_4^+(aq)$, $H_2O(l)$

2012-N-4

- Cu_3Au

  12 carat

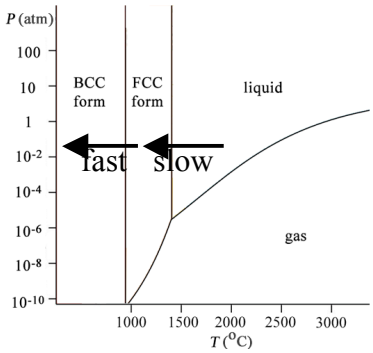
  4.7×10^{-23} cm^3

  14 g cm^{-1}

  Volume of cube = a^3

2012-N-5

- BCC form



The rapid cooling from 1200 to 25 °C does not allow time for the atoms in the FCC arrangement to reorganise themselves into the more stable BCC structure. The process is under kinetic rather than thermodynamic control.

If on the BCC/FCC equilibrium line, an increase in pressure (vertical arrow) would move you into the region which is more dense, *i.e.* has the greater packing efficiency. That is the FCC form, so the line slopes to the left (*i.e.* bottom right to top left).

2012-N-6

The solubility of a salt is reduced by the presence of one of its constituent ions (the common ion) already in the solution.

$Mg(OH)_2(s) \rightarrow Mg^{2+}(aq) + 2OH^-(aq)$

$K_{sp} = [Mg^{2+}(aq)][OH^-(aq)]^2$

1.2×10^{-4} M

10.38

2012-N-7

0.024 M

Yes. The $[OH^-(aq)]$ in the saturated $Mg(OH)_2$ solution is 2.4×10^{-4} M, higher than the $[OH^-(aq)]$ in the buffer solution which remains constant at $10^{-4.76}$ M, *i.e.* 1.7×10^{-5} M. Normally the solubility of a solid decreases because of a high concentration of one of its ions. In this situation, the opposite is observed. Regardless of how much $Mg(OH)_2$ dissolves, the $[OH^-]$ remains below that seen in a saturated solution of $Mg(OH)_2$. Therefore the solubility of $Mg(OH)_2$ increases in this particular buffer.

2012-N-8

The high charge on the Zn^{2+} ion draws electron density out of the O–H bonds in the water molecule. This weakens the O–H so the H^+ is more likely to leave. The water in carbonic anhydrase is therefore more acidic, as shown by the large decrease in pK_a.

Zn^{2+}, $3d^{10}$	↑↓	↑↓	↑↓	↑↓	↑↓
Co^{2+}, $3d^7$	↑↓	↑↓	↑	↑	↑

Zn^{2+} has 0 unpaired *d* electrons, Co^{2+} has 3 unpaired *d* electrons. Co^{2+} is therefore paramagnetic and will be attracted by a magnetic field.

2012-N-9

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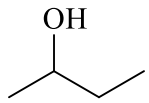
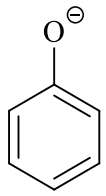
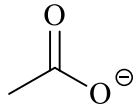
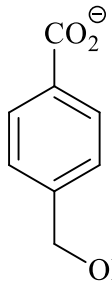
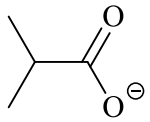






+ $HOCH_2CH_3$





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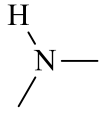
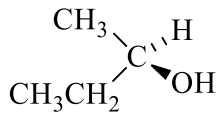
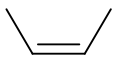


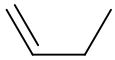
2012-N-10

- Racemic mixture. The geometry around the carbonyl group is trigonal planar, so the H^- nucleophile is equally likely to attack from either the top or bottom. This leads to equal amounts of the (*R*) and (*S*) enantiomers.

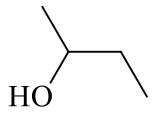
–OH –CH_2CH_3 –CH_3 –H







(*E*)-2-butene (*Z*)-2-butene 1-butene



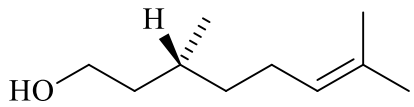
2012-N-11

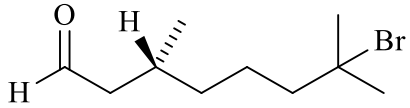
- $C_{10}H_{18}O$

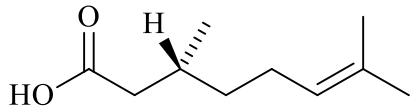
(*R*)

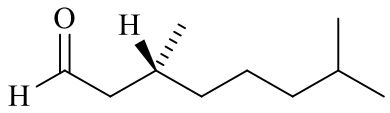
aldehyde, alkene

No. One end of the double bond has two identical groups (methyl) attached to it.









2012-N-12

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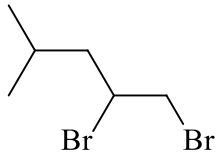
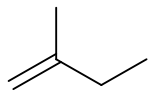
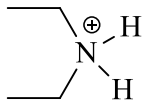
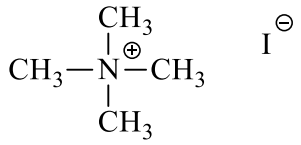
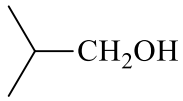
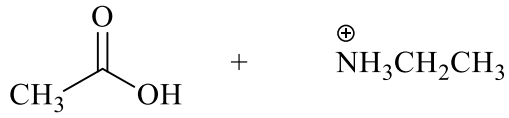






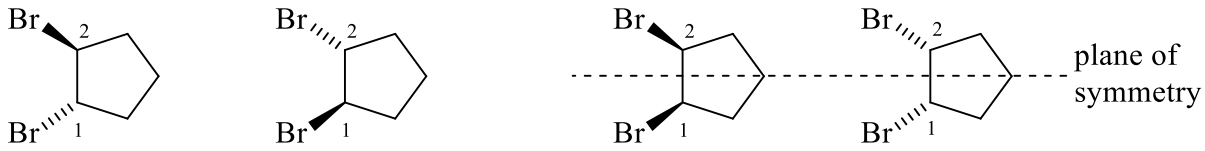






2012-N-13

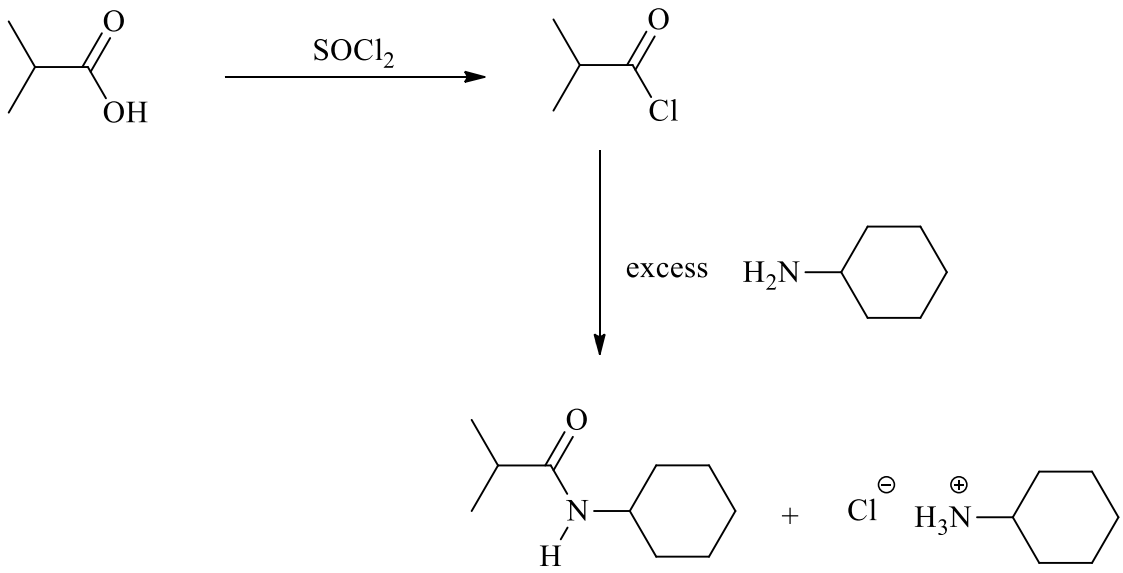
• There are 4 possibilities: (1*R*,2*R*)-, (1*S*,2*S*)-, (1*R*,2*S*)- and (1*S*,2*R*)-. The first two of these are enantiomers. The last two are the same compound, a *meso*- isomer.



(1*S*,2*S*)- (1*R*,2*R*)- (1*R*,2*S*)- (1*S*,2*R*)-

enantiomers *meso*-isomer

2012-N-14

- 

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