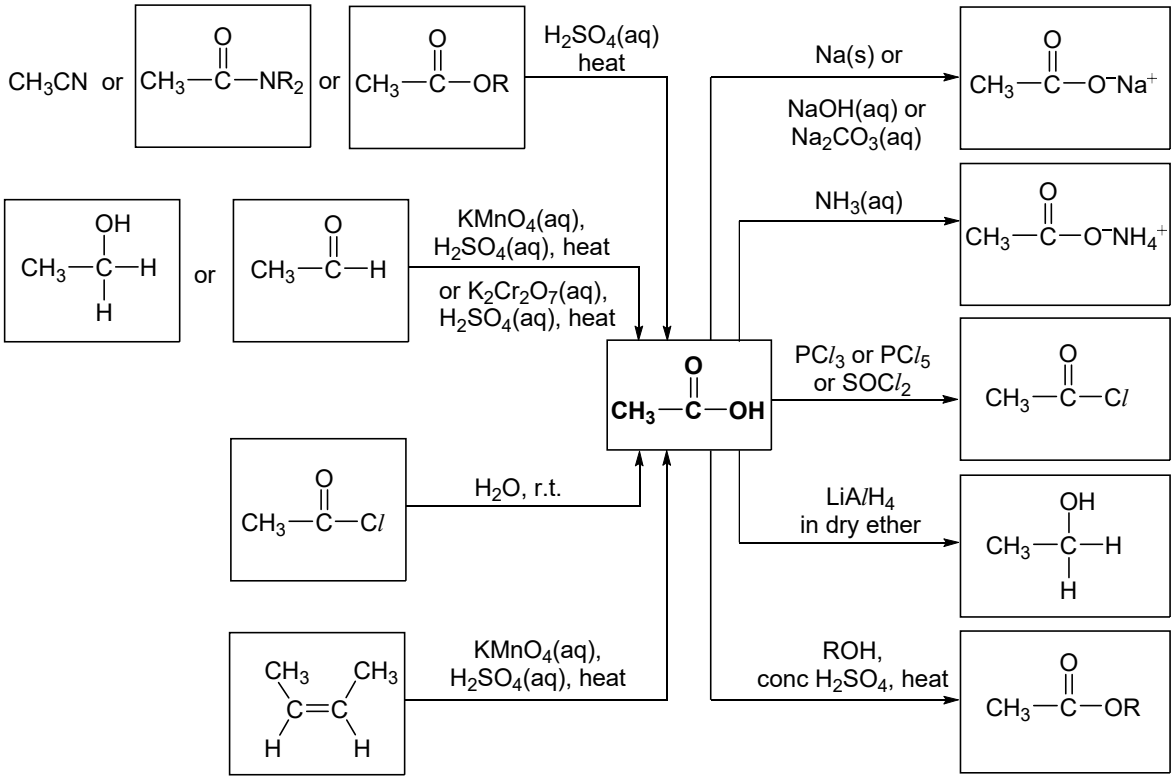
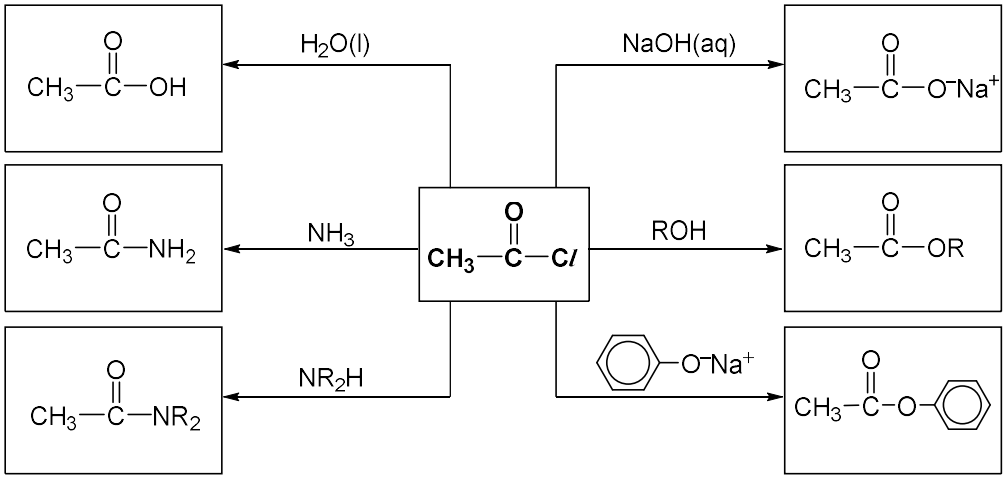
Answers to Self-check questions

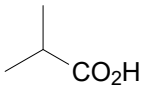
1

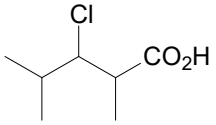
A.

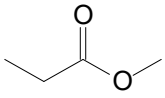


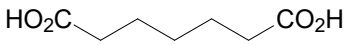
B.



2 **(a)** 

(b) 

(c) 

(d) 

3 **(a)** 2,5-dimethylhexanedioic acid **(b)** ethyl 2,2-dimethylpropanoate
(c) 3-nitrobenzoic acid **(d)** 2,2-dimethylpropanenitrile
(e) 3-ethylhexanoic acid **(f)** 4,5-dibromopentanoic acid

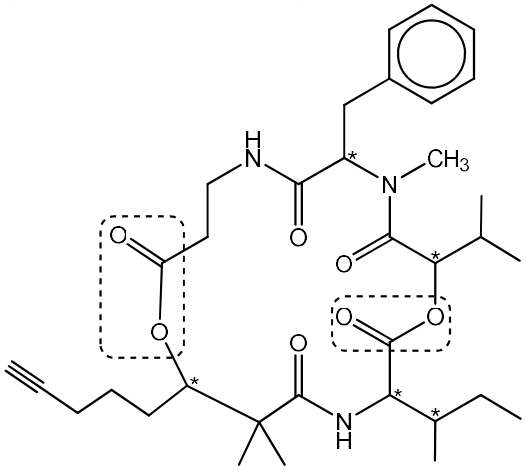
4a Both hydroxyethanoic acid and ethanoic acid are polar molecules held together by strong intermolecular hydrogen bonds (due to the COOH group present). Hydroxyethanoic acid has **more extensive** hydrogen bonding as there is an additional –OH group that can be involved in hydrogen bonding. Thus, more energy is needed to overcome the stronger and more extensive hydrogen bonds between hydroxyethanoic acid molecules and it exists as a solid whereas ethanoic acid exists as a liquid.

4b Ethanoic acid exists as polar molecules held together by stronger intermolecular hydrogen bonds while ethyl ethanoate exists as polar molecules held together by weaker permanent dipole-permanent dipole interactions. More energy is required to overcome the stronger hydrogen bonds between ethanoic acid molecules thus it has a higher boiling point.

4c Benzoic acid can form **hydrogen bonds** with water. However, benzoic acid has limited solubility in water as its large non-polar benzene ring interferes with the formation of hydrogen bonding between the $-CO_2H$ group and water. The energy released in formation of hydrogen bonds between benzoic acid and water is insufficient to compensate the energy required to break the hydrogen bonds between water molecules.

Sodium benzoate, an ionic compound, is soluble in water as it can form **ion-dipole interactions** with water. These interactions are strong enough to release sufficient energy during hydration to overcome strong ionic bonds in sodium benzoate.

5 C
There are 2 ester linkages (circled in dotted rectangles) and 5 chiral carbon atoms (indicated with asterisks) as shown below.



yanucamide B

6 C
Upon acidic hydrolysis of the esters, only the alcohol (ethanol) formed in option **C** will undergo oxidation with alkaline aqueous iodine (positive iodoform test) as it has the $CH_3CH(OH)$- group.

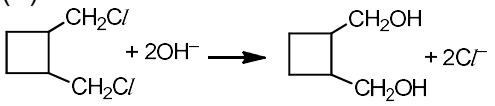
7 B

(A)

$CH_3COCl + 2OH^- \rightarrow H_3COO^- + Cl^- + H_2O$

Amt of Cl^- = Amt of AgCl = 1 ÷ 78.5 = 0.0127 mol
Mass of AgCl = 0.0127 × (35.5+108.0) = 1.83 g

(B)



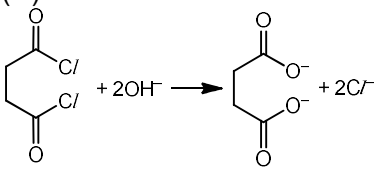
Amt of Cl^- = 2(1 ÷ 153) = 0.01307 mol
Mass of AgCl = 0.01307 × (35.5 + 108.0) = 1.88 g

(C)

No reaction occurs due to partial double bond character in C-Cl bond.

Mass of AgCl = 0 g

(D)



Amt of Cl^- = 2(1 ÷ 155) = 0.0129 mol
Mass of AgCl = 0.0129 × (35.5 + 108.0) = 1.85 g

8 All statements (1, 2 and 3) are correct.