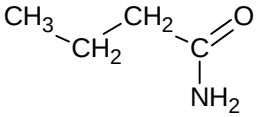
3.5 Organic chemistry 2006 Answers

QUESTION ONE: ISOMERS

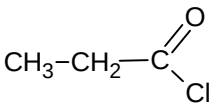
a **i** 1-amino-3-methylbutane

ii



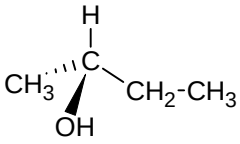
iii 3,4-dimethylpentanal

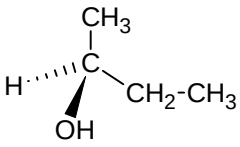
iv



A = 3 of 4 answers correct.

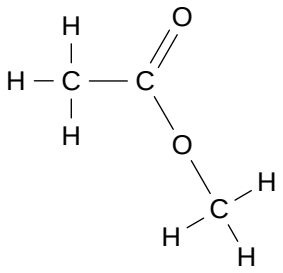
b



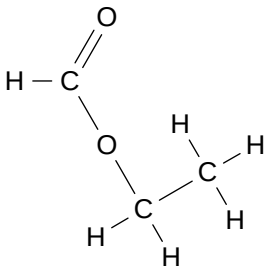


A = Correct isomer identified.
M = Correct isomer identified and both isomers correctly drawn showing 3-dimensional arrangement around chiral C, and correct mirror images.

c **i**



Methyl ethanoate



Ethyl methanoate

A = Name or structural formula correct.
M = Name and structural formula of methyl ethanoate or ethyl methanoate or other valid compounds.

ii	Property	Carboxylic acid	Ester
Physical	**Smell**	Acrid	Sweet, fruity
	BP	Higher	Lower
	Solubility	Soluble in water	Insoluble in water
Chemical	**pH**	Low	Neutral
	Reactions	Weak acid reactions	No acid properties

A = One chemical OR one physical property which is different, described for each isomer.
M = One chemical AND one physical property, which is different described for each isomer.
E = One chemical AND one physical property, which is different, compared for each isomer.

QUESTION TWO: POLYMERS

a **i** Reagent 1 NaOH (KOH, OH^-)
Reagent 2 $SOCl_2$, PCl_3, PCl_5
Reagent 3 NH_3

ii Compound P $HOOC(CH_2)_4COOH$
Compound Q HCl

iii Repeating unit is an amide linkage, i.e. $–HN(CH_2)_6NHOC(CH_2)_4CO–$
(dimer acceptable)

A = Identifies two of the reagents OR identifies compound P as a dicarboxylic acid and Q as HCl OR shows correct functional groups for polymer.
M = Reaction scheme completed with no more than one error.
E = Reaction scheme completed correctly.

b Nylon is easily hydrolysed with acidic solutions as the amide bonds are broken and so monomer molecules are reformed.

$$–HN(CH_2)_6NHOC(CH_2)_4CO– + H^+ \longrightarrow {}^+NH_3(CH_2)_6NH_3^+ + HOOC(CH_2)_4COOH$$

Monomer molecules acceptable (i.e. $NH_2(CH_2)_6NH_2$ and $ClOC(CH_2)_4COCl$).

Teflon is not hydrolysed as the chain involves a series of C–C single bonds that are not easily broken.

A = Links reaction of nylon or lack of reaction of Teflon to the nature of bonding in the structure.
M = Identifies that a hydrolysis reaction occurs for the nylon due to the presence of the amide bonds.
E = Correct explanation and valid equation showing hydrolysis reaction for nylon and repeating unit for Teflon identified.

QUESTION THREE: REACTIONS

a	Reaction	Type	Reagent
	1	Elimination / Dehydration	conc H_2SO_4
	2	Oxidation	$Cr_2O_7^{2-}$ / H^+ or MnO_4^- / H^+
	3	Substitution	$SOCl_2$, PCl_3, PCl_5, conc HCl

A = Correctly identifies two types of reaction OR two reagents.
M = Correctly identifies both types of reaction and reagent, for two reactions.

b i Only the propanal will react with Tollens', Fehling's or Benedict's reagents. The aldehyde reduces Tollens' reagent producing a silver mirror on the side of the test tube (on warming); reduces Benedict's solution, colour change blue to brick-red precipitate; (similar for Fehling's). There is no reaction with the butan-2-ol.

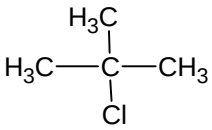
A = Test correctly identified by name or reagent for pair of compounds.
M = Test distinguishing pair described in full.

ii Only the butanoyl chloride will form a solution and react with water to form an acidic solution, which can be tested with blue litmus paper, which turns red. The haloalkane is insoluble in water and does not change the colour of blue litmus paper.

A = Test correctly identified by name or reagent for pair of compounds.
M = Test distinguishing pair described in full.

c i The two clear, colourless solutions would become cloudy on mixing and would then separate out into two layers.

ii



2-chloro-2-methylpropane

A = Two correct from: 1 Correct observation which relates to the formation of an insoluble product. 2. Correct structural formula. 3. Name.

iii (1) Aqueous sodium carbonate is added to neutralise any remaining acid. The anhydrous magnesium sulfate is added to dry the organic product (haloalkane).

A = One valid reason for either reagent.
M = A valid reason for each reagent.

(2) The alkyl halide is insoluble in water and forms a separate layer, which may be removed using the separating funnel (apparatus C). Once the acid has been neutralised, the lower aqueous layer once again needs to be removed using the separating funnel (C).The haloalkane is then placed in the flask and purified by distilling (apparatus D) and only collecting the liquid distilling off close to the BP of the haloalkane**.**

A = One correct apparatus identified, with minimal link to the solubility (apparatus C) or boiling point (apparatus D).
M = Identifies appropriate equipment for one separation and links it to a valid property of the product.
E = Full answer identifying appropriate equipment for both separation techniques including links to a valid property of the product.

Judgement Statement

Chemistry: Describe aspects of organic chemistry (90698)

Achievement

SIX questions answered correctly.

Minimum of 6 × A

Achievement with Merit

SEVEN questions answered correctly, including at least FIVE at Merit level.

Minimum of 5 × M + 2 × A

Achievement with Excellence

EIGHT questions answered correctly, including at least FIVE at Merit level and at least TWO at Excellence level.

Minimum of 2 × E + 5 × M + 1 × A