Carboxylic Acids, Esters & Acyl Chlorides

Question Paper

Level	A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Organic Chemistry II
Sub Topic	Carboxylic Acids, Esters & Acyl Chlorides
Booklet	Question Paper
Paper Type	Multiple Choice

Time Allowed: **42 minutes**

Score: **/35**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Consider the reaction

$$CH_3COOC_2H_5 + CH_3OH \rightleftharpoons CH_3COOCH_3 + C_2H_5OH$$

This is an example of

☒ **A** acylation.

☒ **B** hydrolysis.

☒ **C** substitution.

☒ **D** transesterification.

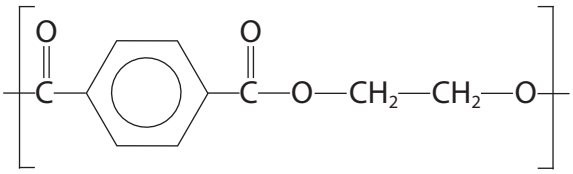
(Total for Question = 1 mark)

2 Polyesters are condensation polymers.

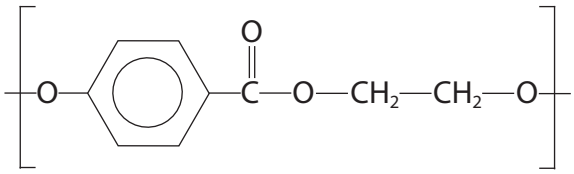
(a) PET, polyethylene terephthalate, can be produced from the condensation of ethane-1,2-diol and benzene-1,4-dicarboxylic acid.

Which of the following is the repeat unit of this polymer?

(1)



☒ **A**



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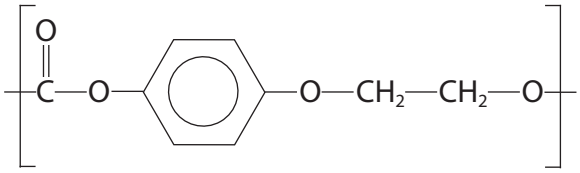
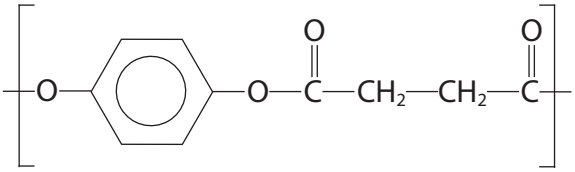
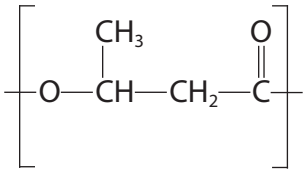


☒ **C**



☒ **D**

(b) The repeat unit of the biodegradable polymer PHB, is shown below.



This is made from a single monomer which could be

(1)

☒ **A** 2-hydroxybutanoic acid.

☒ **B** 3-hydroxybutanoic acid.

☒ **C** 2-hydroxy-2-methylpropanoic acid.

☒ **D** 3-hydroxy-3-methylpropanoic acid.

(Total for Question = 2 marks)

3 Consider the four compounds shown below.

A CH_3COOCH_3

B CH_3COOH

C $CH_3CONHCH_2CH_3$

D CH_3COCl

Which of these compounds

(a) will react most vigorously with water?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) forms methanol when refluxed with aqueous sodium hydroxide?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(c) has at least one triplet in its high resolution proton nmr spectrum?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question = 3 marks)

4 Four organic compounds are:

A CH_3OH

B HCHO

C HCOOH

D $HCOOCH_3$

(a) Which of these compounds has a fruity smell?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) 0.01 mol of each compound is added separately to identical volumes of water. Which solution would have the lowest pH?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(c) 0.01 mol of each compound is heated separately with excess acidified sodium dichromate(VI) solution. Which compound reduces the largest amount of sodium dichromate(VI)?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(d) Which compound has the highest boiling temperature?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(e) Which of these compounds can be oxidized by ammoniacal silver nitrate?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question = 5 marks)

5 Ethanoic acid, CH_3COOH, may be prepared from ethanenitrile, CH_3CN. This reaction is best described as

☒ **A** reduction.

☒ **B** oxidation.

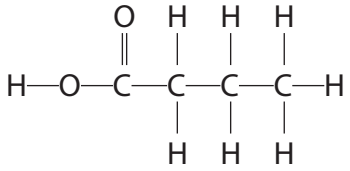
☒ **C** hydrolysis.

☒ **D** condensation.

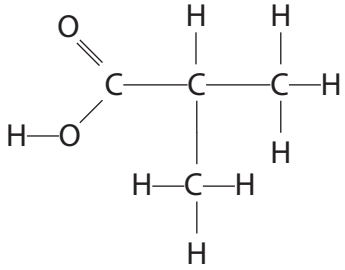
(Total for Question = 1 mark)

6 Propanoic acid reacts with methanol to form an ester. The structure of the ester is

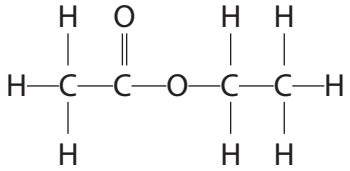
☒ **A**



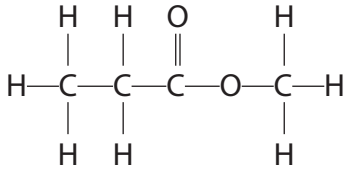
☒ **B**



☒ **C**



☒ **D**



(Total for Question = 1 mark)

7 Transesterification involves the conversion of

☒ **A** esters into different esters.

☒ **B** esters into carboxylic acids.

☒ **C** *cis* carbon-carbon double bonds to the *trans* arrangement.

☒ **D** *trans* carbon-carbon double bonds to the *cis* arrangement.

(Total for Question = 1 mark)

8 The equation for the reaction between ethanoic acid and phosphorus(V) chloride is

☒ **A** $CH_3COOH + PCl_5 \rightarrow CH_3COCl + POCl_3 + HCl$

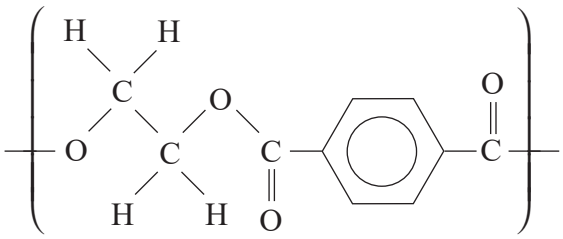
☒ **B** $CH_3COOH + PCl_5 \rightarrow CH_3COOCl + PCl_3 + HCl$

☒ **C** $CH_3COOH + PCl_5 \rightarrow CH_3COCl + PCl_3 + HOCl$

☒ **D** $2CH_3COOH + PCl_5 \rightarrow (\int H_3CO)_2O + PCl_3 + H_2O + Cl_2$

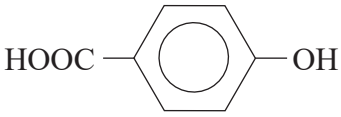
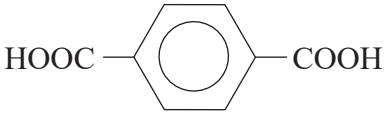
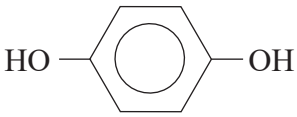
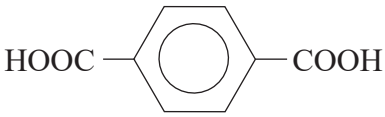
(Total for Question = 1 mark)

9 An example of a polyester is



(a) The two monomers needed to form this polymer are

(1)

	Monomer One	Monomer Two
☒ **A**		$HO(CH_2)_2OH$
☒ **B**		$HO(CH_2)_2OH$
☒ **C**		$HOOC(CH_2)_2COOH$
☒ **D**		$HOOC(CH_2)_2COOH$

(b) The type of reaction to form this polymer is

(1)

☒ **A** addition.

☒ **B** substitution.

☒ **C** condensation.

☒ **D** hydrolysis.

(Total for Question = 2 marks)

10 Which of the following methods would **not** be suitable for measuring the rate of the reaction between methanoic acid and bromine?

$$HCOOH(aq) + Br_2(aq) \rightarrow 2H^+(aq) + 2Br^-(aq) + CO_2(g)$$

☒ **A** Colorimetry

☒ **B** Measuring change in electrical conductivity

☒ **C** Quenching samples and titrating with acid

☒ **D** Measuring change in pressure

(Total for Question = 1 mark)

11 Ethanoic acid is **not** a product in the reaction of

☒ **A** ethanal with lithium tetrahydridoaluminate.

☒ **B** ethanoyl chloride with water.

☒ **C** ethyl ethanoate with dilute sulfuric acid.

☒ **D** ethanol refluxed with potassium dichromate(VI) and sulfuric acid.

(Total for Question = 1 mark)

12 The following methods can be used to distinguish between pairs of organic compounds without further tests.

A Warm each compound with Fehling's or Benedict's solution.

B Add solid sodium carbonate to each compound.

C Add 2,4-dinitrophenylhydrazine (Brady's reagent) to each compound.

D Add water, drop by drop, to each compound.

(a) Which test would distinguish propanone from propan-1-ol?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) Which test would distinguish between aqueous solutions of ethanoic acid and ethanol?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(c) Which test would distinguish ethanoyl chloride from ethanol?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question = 3 marks)

13 Ethanoic acid is **not** a product in the reaction of

☒ **A** ethanal with lithium tetrahydridoaluminate.

☒ **B** ethanoyl chloride with water.

☒ **C** ethyl ethanoate with dilute sulfuric acid.

☒ **D** ethanol refluxed with potassium dichromate(VI) and sulfuric acid.

(Total for Question = 1 mark)

14 Ethanoic acid, CH_3COOH, can be converted into ethanoyl chloride, CH_3COCl, by the action of

☒ **A** phosphorus(V) chloride.

☒ **B** chlorine.

☒ **C** dilute hydrochloric acid.

☒ **D** concentrated hydrochloric acid.

(Total for Question = 1 mark)

15 Which of these is **not** observed when ethanoyl chloride reacts with water?

☒ **A** Misty fumes given off.

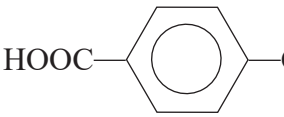
☒ **B** The gas given off turns damp blue litmus paper red.

☒ **C** The mixture gets hot.

☒ **D** A white precipitate forms.

(Total for Question = 1 mark)

16 Butane-1,4-diol, $HO(CH_2)_4OH$, and benzene-1,4-dicarboxylic acid,

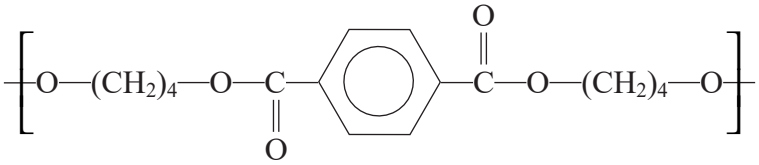


react to form a polyester.

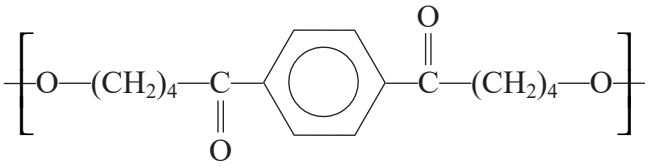
(a) The repeat unit of the polyester is

(1)

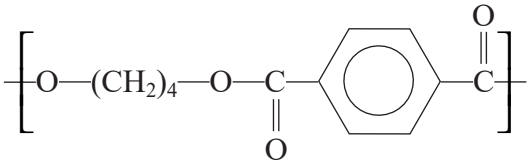
☒ **A**



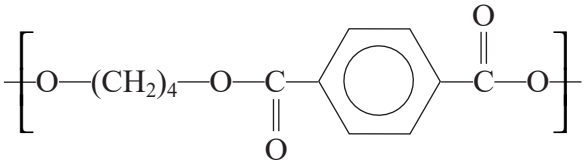
☒ **B**



☒ **C**



☒ **D**



(b) The type of reaction is

(1)

☒ **A** hydrolysis.

☒ **B** addition.

☒ **C** substitution.

☒ **D** condensation.

(Total for Question = 2 marks)

17 A compound is known to have either the structure $H_2NCH_2CH_2NH_2$ or H_2NCH_2COOH. Which of the following tests would best distinguish between the two compounds?

☒ **A** Reaction with concentrated aqueous sodium hydroxide.

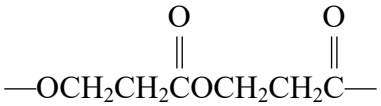
☒ **B** Reaction with nitrous acid.

☒ **C** Reaction with aqueous sodium hydrogencarbonate.

☒ **D** Reaction with ethanoyl chloride.

(Total for Question = 1 mark)

18 A section of a polymer is shown below. Which of the following monomers would form this polymer?



☒ **A** $HOCH_2CH_2OH$ and $ClCOCH_2CH_2COCl$

☒ **B** $HOCH_2CH_2OH$ and $HOOCCH_2CH_2COOH$

☒ **C** $ClCH_2CH_2COCl$ alone

☒ **D** $HOCH_2CH_2COOH$ alone

(Total for Question = 1 mark)

19 This question concerns the following organic compounds.

A CH_3COCl

B CH_3COOH

C $CH_3COOCH_2CH_3$

D C_6H_5OH

Which compound is most likely to

(a) form the solution with the lowest pH when mixed with water?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) burn with a smoky flame?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(c) have a fruity smell?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(d) have an absorption in its IR spectrum at about 1795 cm^{-1}?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question = 4 marks)

20 Which of the following molecules is a methyl ester?

- ☒ **A** $CH_3COOCH_2CH_3$
- ☒ **B** $HCOOCH_3$
- ☒ **C** $CH_3COCH_2CH_3$
- ☒ **D** CH_3COCl

(Total for Question = 1 mark)

21 Which of the following compounds would react with lithium tetrahydridoaluminate (lithium aluminium hydride) **and** also with phosphorus(V) chloride (phosphorus pentachloride)?

- ☒ **A** $CH_3CH_2CH_2COOH$
- ☒ **B** $CH_3CH_2COCH_3$
- ☒ **C** $CH_3CH{=}CHCH_3$
- ☒ **D** $CH_2{=}CHCH_2CH_2OH$

(Total for Question = 1 mark)

22 In the synthesis of an ester, the use of an acyl chloride and an alcohol gives a better yield than the use of a carboxylic acid and an alcohol.

This is because the reaction between

- ☒ **A** an acyl chloride and an alcohol is an equilibrium.
- ☒ **B** an acid and an alcohol goes to completion.
- ☒ **C** an acid and an alcohol requires a catalyst.
- ☒ **D** an acyl chloride and an alcohol goes to completion.

(Total for Question = 1 mark)

23 Which of the following methods may be used **in a single step** to make carboxylic acids?

☒ **A** Hydrolysis of an ester with an alkali.

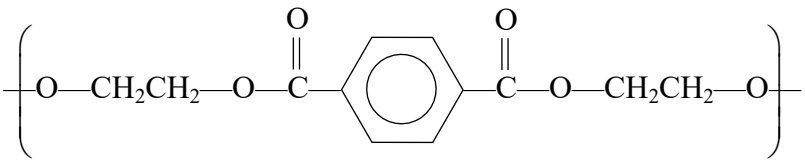
☒ **B** Reaction of acidified potassium manganate(VII) with an alkene.

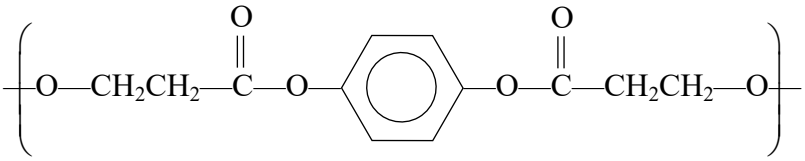
☒ **C** Hydrolysis of a nitrile with hydrochloric acid.

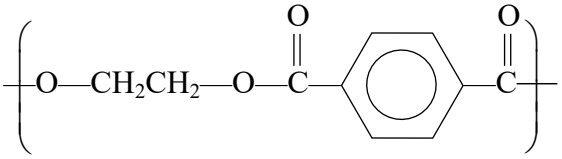
☒ **D** Reaction of an acyl chloride with ammonia.

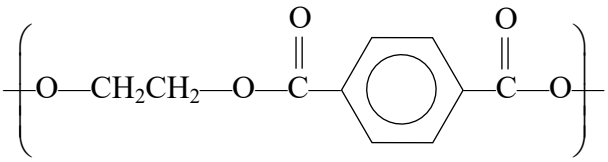
(Total for Question = 1 mark)

24 The repeat unit of the polyester formed from ethane-1,2-diol, $HOCH_2CH_2OH$, and benzene-1,4-dicarboxylic acid, HOOC—C$_6$H$_4$—COOH, is

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(Total for Question = 1 mark)