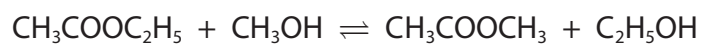


1 Consider the reaction



This is an example of

- A acylation.
- B hydrolysis.
- C substitution.
- D transesterification.

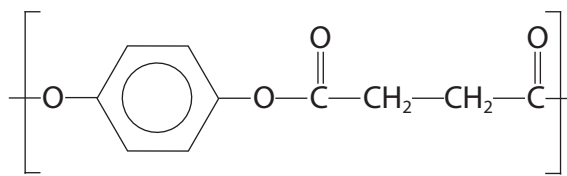
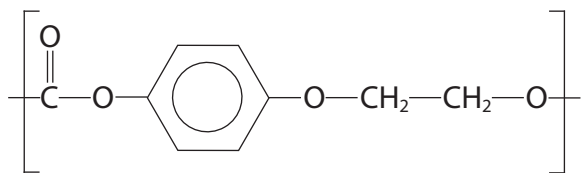
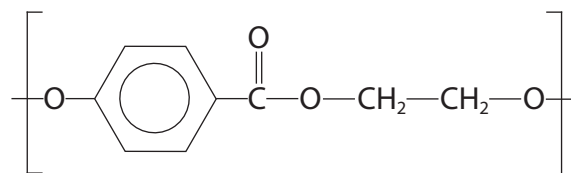
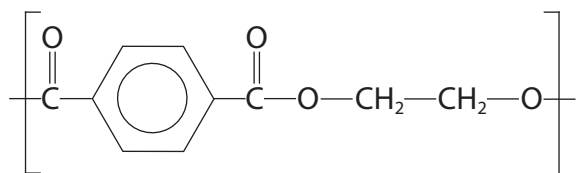
(Total for Question = 1 mark)

2 Polyesters are condensation polymers.

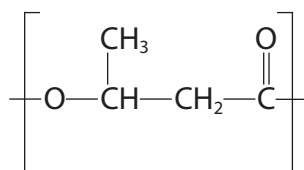
(a) PET, polyethylene terephthalate, can be produced from the condensation of ethane-1,2-diol and benzene-1,4-dicarboxylic acid.

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

(1)



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



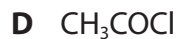
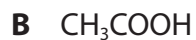
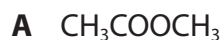
This is made from a single monomer which could be

(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.



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) 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.

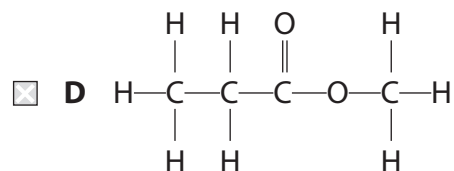
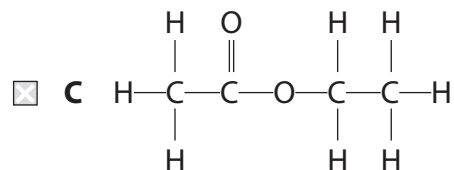
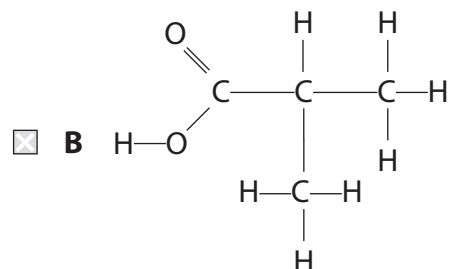
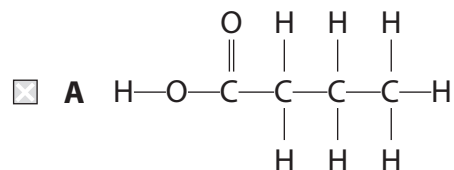
B oxidation.

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



(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.

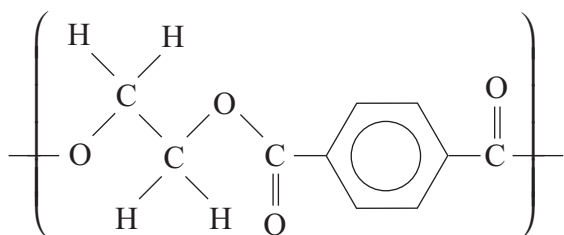
(Total for Question = 1 mark)

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

- A $\text{CH}_3\text{COOH} + \text{PCl}_5 \rightarrow \text{CH}_3\text{COCl} + \text{POCl}_3 + \text{HCl}$
- B $\text{CH}_3\text{COOH} + \text{PCl}_5 \rightarrow \text{CH}_3\text{COOCl} + \text{PCl}_3 + \text{HCl}$
- C $\text{CH}_3\text{COOH} + \text{PCl}_5 \rightarrow \text{CH}_3\text{COCl} + \text{PCl}_3 + \text{HOCl}$
- D $2\text{CH}_3\text{COOH} + \text{PCl}_5 \rightarrow (\text{CH}_3\text{CO})_2\text{O} + \text{PCl}_3 + \text{H}_2\text{O} + \text{Cl}_2$



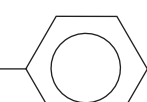
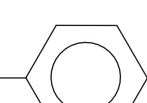
(Total for Question 1 mark)

9 An example of a polyester is



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

(1)

| | Monomer One | Monomer Two |
|----------------------------|---|--|
| <input type="checkbox"/> A | HOOC-  -OH | HO(CH ₂) ₂ OH |
| <input type="checkbox"/> B | HOOC-  -COOH | HO(CH ₂) ₂ OH |
| <input type="checkbox"/> C | HO-  -OH | HOOC(CH ₂) ₂ COOH |
| <input type="checkbox"/> D | HOOC-  -COOH | HOOC(CH ₂) ₂ COOH |

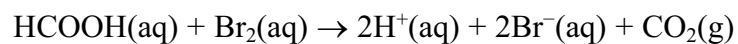
(b) The type of reaction to form this polymer is

(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?



- 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 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)

12 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)

13 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.

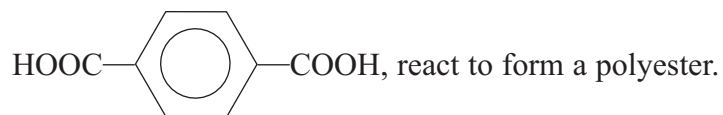
(Total for Question = 1 mark)

14 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.

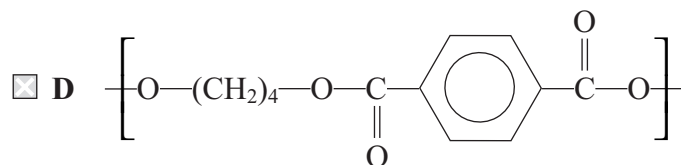
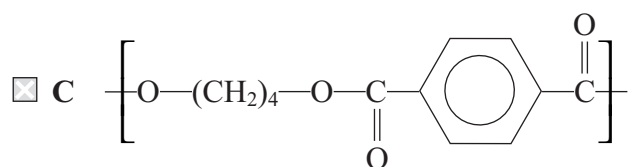
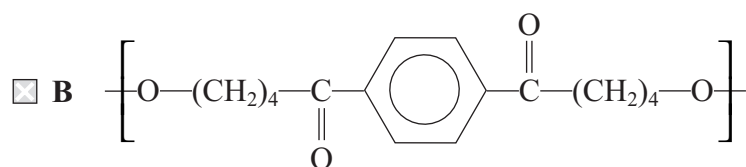
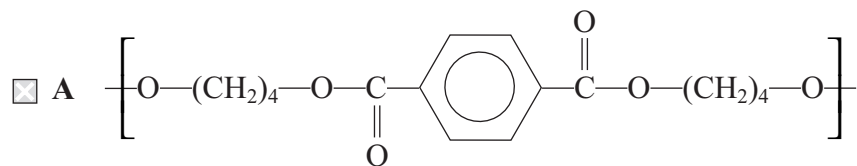
(Total for Question 1 mark)

15 Butane-1,4-diol, $\text{HO}(\text{CH}_2)_4\text{OH}$, and benzene-1,4-dicarboxylic acid,



(a) The repeat unit of the polyester is

(1)



(b) The type of reaction is

(1)

- A** hydrolysis.
- B** addition.
- C** substitution.
- D** condensation.

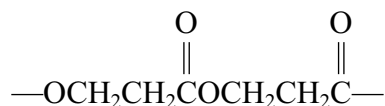
(Total for Question 2 marks)

16 A compound is known to have either the structure $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ or $\text{H}_2\text{NCH}_2\text{COOH}$. 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)

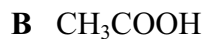
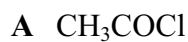
17 A section of a polymer is shown below. Which of the following monomers would form this polymer?



- A $\text{HOCH}_2\text{CH}_2\text{OH}$ and $\text{ClCOCH}_2\text{CH}_2\text{COCl}$
- B $\text{HOCH}_2\text{CH}_2\text{OH}$ and $\text{HOOCCH}_2\text{CH}_2\text{COOH}$
- C $\text{ClCH}_2\text{CH}_2\text{COCl}$ alone
- D $\text{HOCH}_2\text{CH}_2\text{COOH}$ alone

(Total for Question 1 mark)

18 This question concerns the following organic compounds.



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)

19 Which of the following molecules is a methyl ester?

- A $\text{CH}_3\text{COOCH}_2\text{CH}_3$
- B HCOOCH_3
- C $\text{CH}_3\text{COCH}_2\text{CH}_3$
- D CH_3COCl

(Total for Question = 1 mark)

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

- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- B $\text{CH}_3\text{CH}_2\text{COCH}_3$
- C $\text{CH}_3\text{CH}=\text{CHCH}_3$
- D $\text{CH}_2=\text{CHCH}_2\text{CH}_2\text{OH}$

(Total for Question = 1 mark)

21 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)

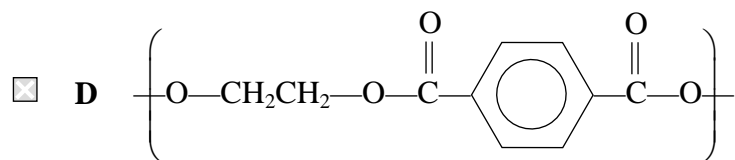
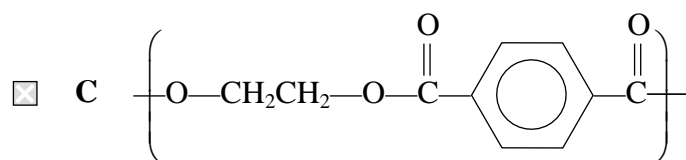
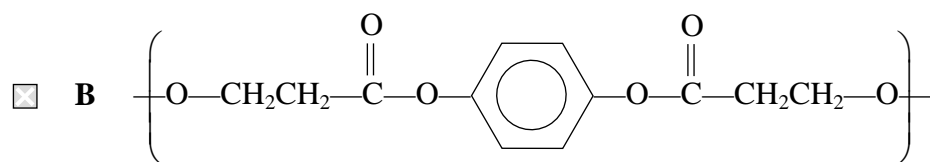
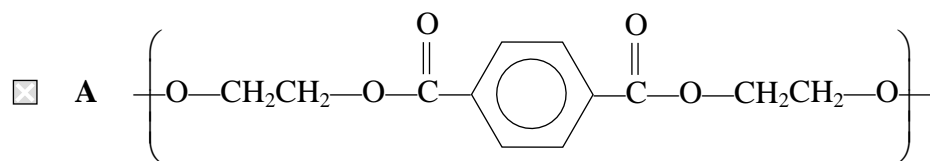
22 Which of the following methods may be used **in a single step** to make carboxylic acids?

- 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)

23 The repeat unit of the polyester formed from ethane-1,2-diol, HOCH₂CH₂OH, and

benzene-1,4-dicarboxylic acid, HOOC--COOH, is



(Total for Question = 1 mark)