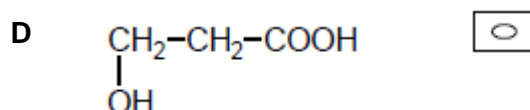
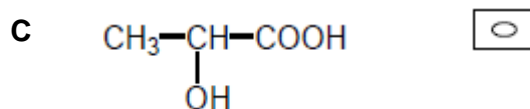
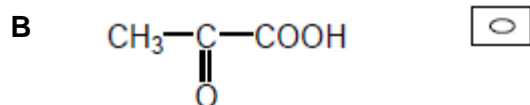
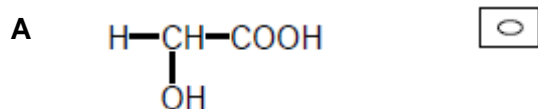


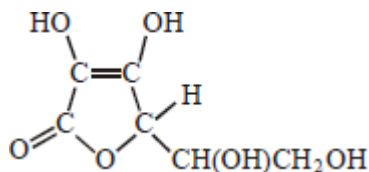
1 A drug is designed to simulate one of the following molecules that adsorbs onto the active site of an enzyme.

Which molecule requires the design of an optically active drug?



(Total 1 mark)

2 Which one of the following is **not** a correct statement about vitamin C, shown below?



- A It is a cyclic ester.
- B It can form a carboxylic acid on oxidation.
- C It decolourises a solution of bromine in water.
- D It is a planar molecule.

(Total 1 mark)

3 In which one of the following mixtures does a redox reaction occur?

- A ethanal and Tollens' reagent
- B ethanoyl chloride and ethanol
- C ethanal and hydrogen cyanide
- D ethanoic acid and sodium hydroxide

(Total 1 mark)

4 Propanoic acid reacts with methanol in the presence of a small amount of concentrated sulphuric acid. The empirical formula of the ester formed is

- A CH_2O
- B $\text{C}_2\text{H}_6\text{O}_2$
- C $\text{C}_2\text{H}_4\text{O}_2$
- D $\text{C}_2\text{H}_4\text{O}$

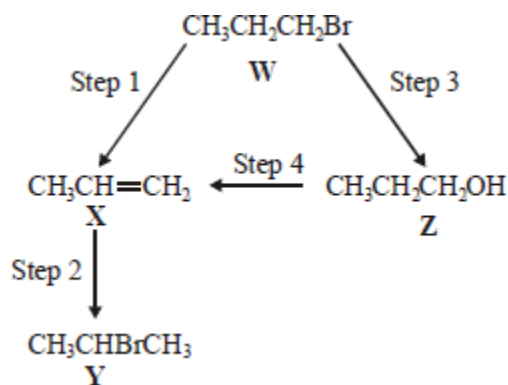
(Total 1 mark)

5 Which one of the following is **not** a correct general formula for the non-cyclic compounds listed?

- A alcohols $\text{C}_n\text{H}_{2n+2}\text{O}$
- B aldehydes $\text{C}_n\text{H}_{2n+1}\text{O}$
- C esters $\text{C}_n\text{H}_{2n}\text{O}_2$
- C primary amines $\text{C}_n\text{H}_{2n+3}\text{N}$

(Total 1 mark)

6 For this question refer to the reaction scheme below.



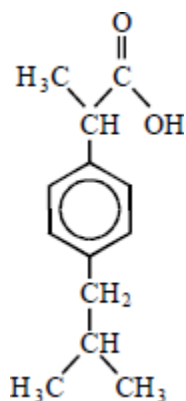
Which one of the following statements is **not** correct?

- A Reaction of **W** with sodium cyanide followed by hydrolysis of the resulting product gives propanoic acid.
- B Mild oxidation of **Z** produces a compound that reacts with Tollens' reagent, forming a silver mirror.
- C **Z** reacts with ethanoic acid to produce the ester propyl ethanoate.
- C **W** undergoes addition polymerisation to form poly(propene).

(Total 1 mark)

7

Ibuprofen is a drug used as an alternative to aspirin for the relief of pain, fever and inflammation. The structure of ibuprofen is shown below.



Which one of the following statements is **not** correct?

- A It has optical isomers.
- B It liberates carbon dioxide with sodium carbonate solution.
- D It undergoes esterification with ethanol.
- D It undergoes oxidation with acidified potassium dichromate(VI).

(Total 1 mark)

8

Butan-1-ol was converted into butyl propanoate by reaction with an excess of propanoic acid. In the reaction, 6.0 g of the alcohol gave 7.4 g of the ester. The percentage yield of ester was

- A 57
- B 70
- C 75
- D 81

(Total 1 mark)

9

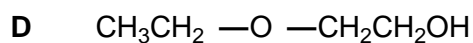
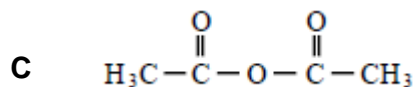
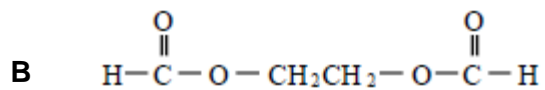
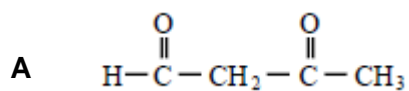
Which one of the following would **not** react with aqueous silver nitrate to produce a precipitate that is soluble in concentrated aqueous ammonia?

- A CaBr₂
- B [COCl₄]²⁻
- C (CH₃)₄N⁺I⁻
- D CH₃COCl

(Total 1 mark)

10

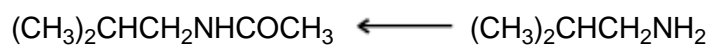
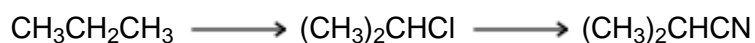
Which compound is formed by the reaction of ethane-1,2-diol with an acid?



(Total 1 mark)

11

Which one of the following types of reaction mechanism is **not** involved in the above sequence?

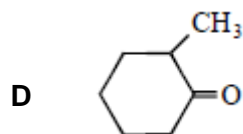
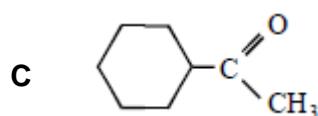
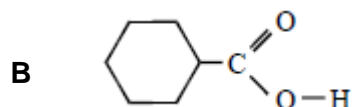
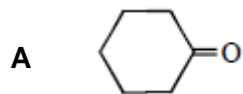


- A free-radical substitution
- B nucleophilic substitution
- C elimination
- D nucleophilic addition-elimination

(Total 1 mark)

- 12** The compound lithium tetrahydridoaluminate(III), LiAlH_4 , is a useful reducing agent. It behaves in a similar fashion to NaBH_4 . Carbonyl compounds and carboxylic acids are reduced to alcohols. However, LiAlH_4 also reduces water in a violent reaction so that it must be used in an organic solvent.

Which one of the following can be reduced by LiAlH_4 to a primary alcohol?



(Total 1 mark)

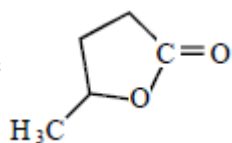
- 13** An excess of methanol was mixed with 12 g of ethanoic acid and an acid catalyst. At equilibrium the mixture contained 8 g of methyl ethanoate. The percentage yield of ester present was

- A** 11
B 20
C 54
D 67

(Total 1 mark)

14

Acid hydrolysis of



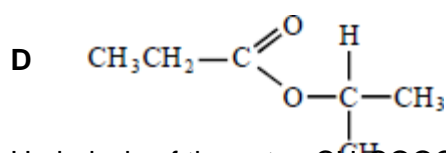
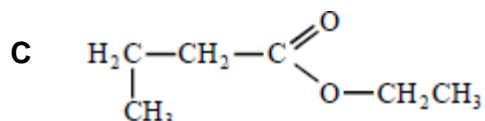
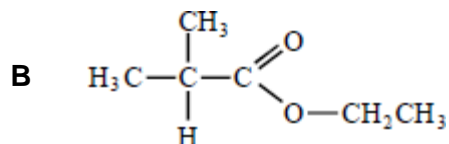
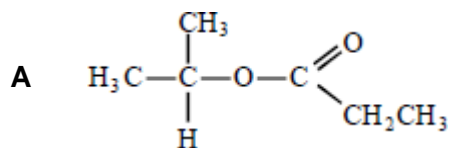
produces

- A** $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{COOH}$
B $\text{CH}_2(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
C $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{OCHO}$
D $\text{CH}_2(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_2\text{OCHO}$

(Total 1 mark)

15

The structural formula of ethyl 2-methylpropanoate is



(Total 1 mark)

16

Hydrolysis of the ester, $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$, produces ethanoic acid. In an experiment, 2.04 g of the ester was used and 0.90 g of ethanoic acid was produced. The percentage yield of ethanoic acid was:

- A 44
B 59
C 75
D 90

(Total 1 mark)

17

How many structural isomers, which are esters, have the molecular formula $\text{C}_4\text{H}_8\text{O}_2$?

- A 2
B 3
C 4
D 5

(Total 1 mark)

18 CH₂O is the empirical formula of

- A methanol
- B methyl methanoate
- C ethane-1,2-diol
- D butanal

(Total 1 mark)

19 Summarised directions for recording responses to multiple completion questions

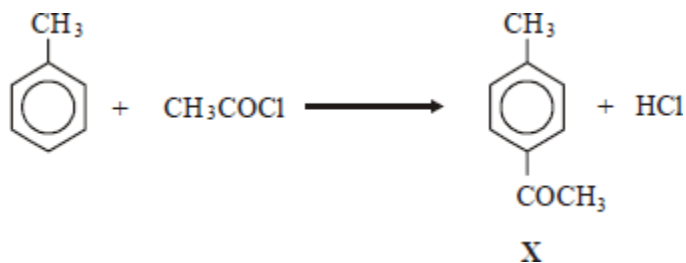
A	B	C	D
(i), (ii) and (iii) only	(i) and (iii) only	(ii) and (iv) only	(iv) alone

Isomers of the ester HCOOCH₂CH₂CH₃, include

- (i) ethyl ethanoate
- (ii) methyl propanoate
- (iii) butanoic acid
- (iv) butyl methanoate

(Total 1 mark)

20 Ethanoyl chloride reacts with methylbenzene forming compound X according to the equation below.



If the experimental yield is 40.0%, the mass in grams of X ($M_r = 134.0$) formed from 18.4 g of methylbenzene ($M_r = 92.0$) is

- A 26.8
- B 16.1
- C 10.7
- D 7.4

(Total 1 mark)

21

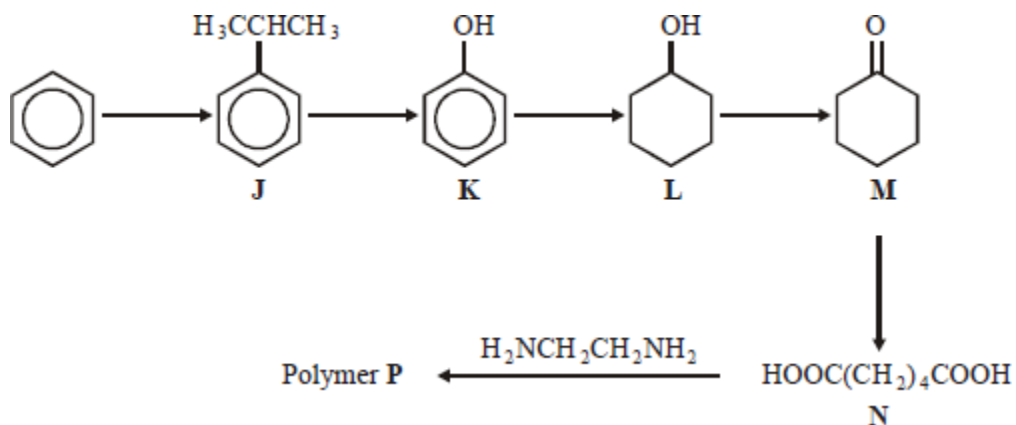
In a reaction which gave a 27.0% yield, 5.00 g of methylbenzene were converted into the explosive 2,4,6-trinitromethylbenzene (TNT) ($M_r = 227.0$). The mass of TNT formed was

- A 1.35 g
 B 3.33 g
 C 3.65 g
 D 12.34 g

(Total 1 mark)

22

This question is about the following reaction scheme which shows the preparation of polymer P.



If 1.0 kg of benzene gave 0.98 kg of J, the percentage yield of J was

- A 64
 B 66
 C 68
 D 70

(Total 1 mark)

23

In which one of the following reactions is the role of the reagent stated correctly?

	Reaction	Role of reagent
A	$\text{TiO}_2 + 2\text{C} + 2\text{Cl}_2 \rightarrow \text{TiCl}_4 + 2\text{CO}$	TiO_2 is an oxidising agent
B	$\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{NO}_3^+ + \text{HSO}_4^-$	HNO_3 is a Brønsted-Lowry acid
C	$\text{CH}_3\text{COCl} + \text{AlCl}_3 \rightarrow \text{CH}_3\text{CO}^+ + \text{AlCl}_4^-$	AlCl_3 is a Lewis base
D	$2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$	CO is a reducing agent

(Total 1 mark)

24 The relative molecular mass (M_r) of benzene-1,4-dicarboxylic acid is

- A 164
- B 166
- C 168
- C 170

(Total 1 mark)

25 1,3-dinitrobenzene can be prepared by heating nitrobenzene with a mixture of fuming nitric acid and concentrated sulphuric acid. The reaction can be represented by the following equation.



If the yield of the reaction is 55%, the mass of 1,3-dinitrobenzene produced from 12.30 g of nitrobenzene is

- A 16.90 g
- B 16.80 g
- C 9.30 g
- D 9.24 g

(Total 1 mark)

26 Which one of the following can react both by nucleophilic addition and by nucleophilic substitution?

- A $\text{CH}_3-\text{C}(=\text{O})-\text{CH}=\text{CH}_2$
- B $\text{H}_2\text{C}(\text{Cl})-\text{CH}_2-\text{C}(=\text{O})\text{H}$
- C $\text{H}_2\text{C}(\text{Cl})-\text{CH}=\text{CH}_2$
- D $\text{CH}_3-\text{C}(=\text{O})-\text{C}_6\text{H}_5$

(Total 1 mark)

27 Which one of the following does **not** contain any delocalised electrons?

- A poly(propene)
- B benzene
- C graphite
- D sodium

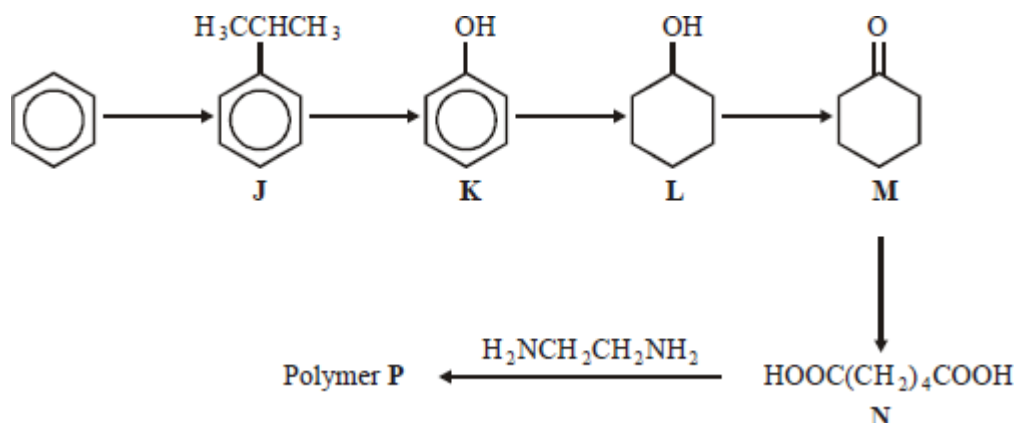
(Total 1 mark)

28 Which one of the following reactions does **not** involve donation of an electron pair?

- A $H^+ + CH_3NH_2 \rightarrow CH_3NH_3^+$
- B $AlCl_3 + Cl^- \rightarrow AlCl_4^-$
- C $CH_3Cl + CN^- \rightarrow CH_3CN + Cl^-$
- D $\frac{1}{2}Cl_2 + I^- \rightarrow Cl^- + \frac{1}{2}I_2$

(Total 1 mark)

29 This question is about the following reaction scheme which shows the preparation of polymer **P**.



Polymer **P** is formed in a two-step reaction from **N**. The first stage is a neutralisation reaction. The volume, in cm^3 , of a 0.20 mol dm^{-3} solution of $H_2NCH_2CH_2NH_2$ required to neutralise $6.8 \times 10^{-3} \text{ mol}$ of the acid **N** is

- A 17
- B 34
- C 68
- D 136

(Total 1 mark)

30

Which compound can polymerise by reaction with itself?

- A $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- B $\text{CH}_3\text{CH}_2\text{CONH}_2$
- C $\text{HOOCCH}_2\text{COOH}$
- D $\text{NH}_2\text{CH}_2\text{COCl}$

(Total 1 mark)

31

Terylene is made by reacting benzene-1,4-dicarboxylic acid and ethane-1,2-diol.

Terylene is

- A an addition polymer.
- B a polyamide.
- C a polyester.
- D a nylon.

(Total 1 mark)

Mark schemes

1	^C	[1]
2	^D	[1]
3	^A	[1]
4	^D	[1]
5	^B	[1]
6	^A	[1]
7	^D	[1]
8	^B	[1]
9	^C	[1]
10	^B	[1]
11	^C	[1]
12	^B	[1]
13	^C	[1]
14	^A	[1]
15	^B	[1]
16	^C	[1]
17	^C	[1]
18	^B	[1]

^A
19

[1]

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22

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^B
29

[1]

30

D

[1]

^C
31

[1]