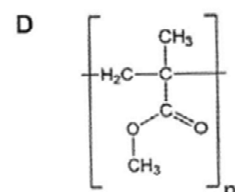
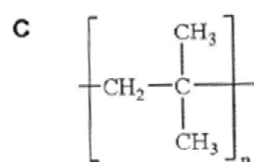
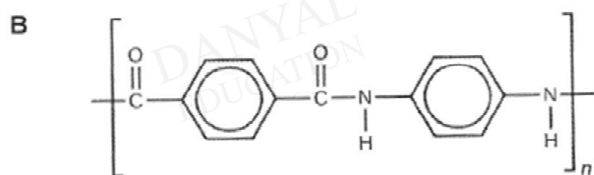
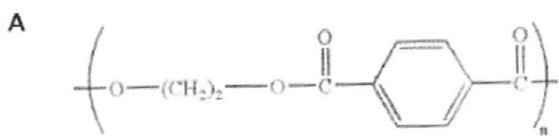


O Level Pure Chemistry Structured

Organic Chemistry Test 5.0

Q1

The diagram below shows the structure of some polymers **A**, **B**, **C** and **D**.



- (a) A sample of **C** contain molecules with an average relative molecular mass of 14 000.
 How many carbon atoms are there in an average molecule of the polymer?

[1]

- (b) Which of the statements would you predict to be true and which to be false?
 Put a tick (✓) in one box in each row.

	true	false
D is a polyester.		
Water is formed as a by-product when monomers react to form A and B .		
The empirical formula of C is the same as its monomer.		
One of the monomers that react to form B is an alcohol.		

[2]

- c) Draw the displayed formulae of the monomers that react to form **A**.

[2]

(d) (i) Draw the structural formula of the monomer that react to form D.

[1]

(ii) The monomer in (d)(i) can be formed by reacting an acid and an alcohol under suitable conditions.
Draw the structural formulae of the acid and alcohol.

[2]

(iii) State the conditions required for the reaction in (d)(ii).

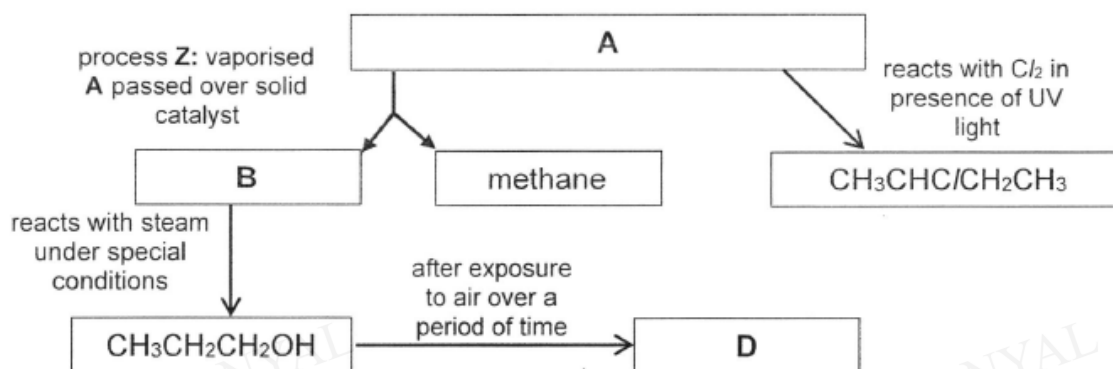
[1]

(e) A, B, C and D are non-biodegradable.
Explain why being non-biodegradable is both an advantage and a disadvantage.

[2]

Q2

The reaction scheme of organic compound **A** is shown below.



- (a) (i) Name the process **Z** and state the solid catalyst used.

_____ [2]

- (ii) Describe a test to differentiate compound **A** from **B**.

 _____ [2]

- (iii) Construct a balanced chemical equation for process **Z**.

_____ [1]

- (b) Describe a test to prove that $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ has been completely converted to **D**.

 _____ [2]

- (c) (i) Molecules of **B** can undergo addition polymerisation to form a polymer with a relative molecular mass of 33600. How many monomers of **B** are required to form this polymer?

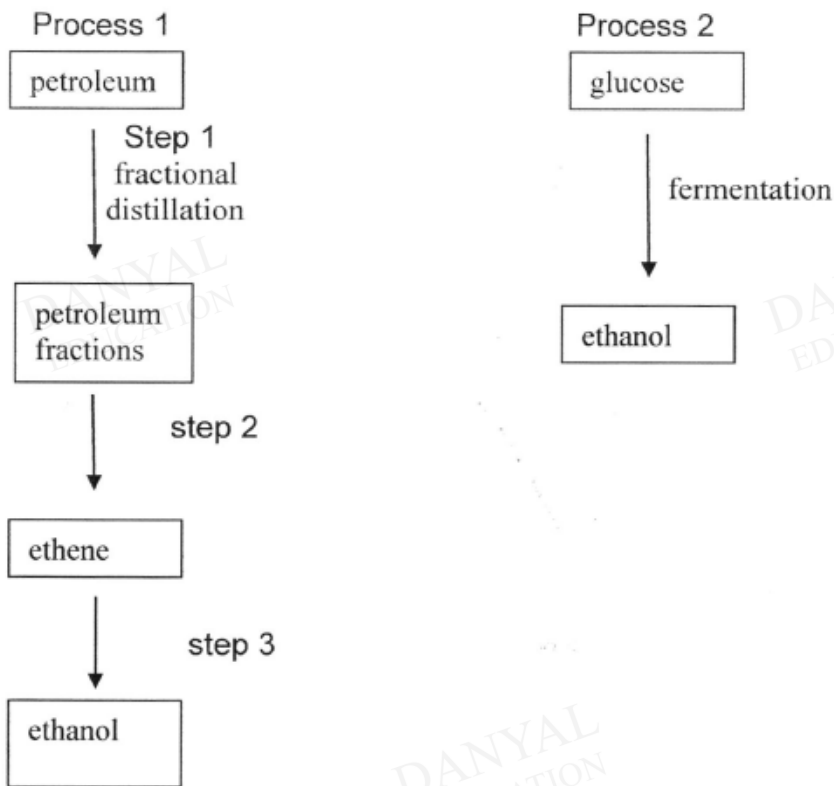
_____ [1]

- (ii) With reference to their structures, state one similarity and one difference between monomer **B** and its polymer,

 _____ [2]

Q3

Ethanol can be manufactured by two processes. The flowcharts outline the sequence of steps for producing ethanol.



(a) Name the process in step 2

[1]

(b) State 2 conditions for step 3.

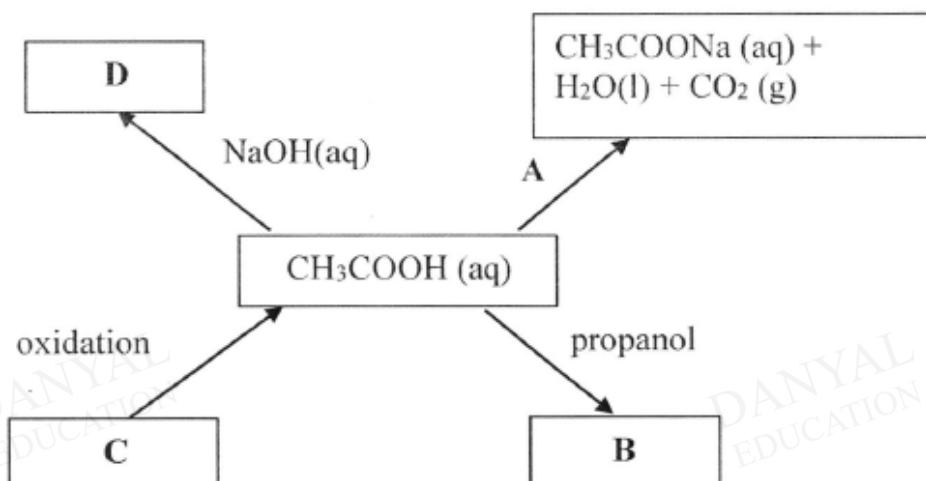
[2]

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Q4

Four reactions of ethanoic acid CH_3COOH , are shown below.



(a) Name substance **A** that is added to ethanoic acid. [1]

(b) Name substance **B** and the catalyst in the spaces below. [2]

Substance B _____

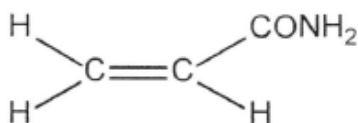
Catalyst _____

(c) Name substance **C**, and state the reagents and/or condition(s) for the oxidation reaction that **C** undergoes in the laboratory to form ethanoic acid. [2]

(d) Write the balanced chemical equation, including state symbols, for the formation of substance **D**. [2]

Q5

In 2002, Swedish scientists found high levels of acrylamide in starchy foods that had been cooked above 120 °C. Acrylamide, which is thought to be toxic to human health, has the following structure as shown in the figure below.



(a) Acrylamide polymerises to polyacrylamide. Interestingly, polyacrylamide is non-toxic and is used as an ingredient in a variety of cosmetic and beauty products, including skin cleansers, moisturisers, lotions and creams. Small polyacrylamide beads may also be used in skin cleansing products as an abrasive.

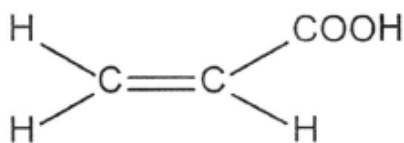
(i) Draw the structure of polyacrylamide. [1]

(ii) What type of polymerisation is this? [1]

(iii) Calculate the maximum mass of polyacrylamide that can be made from 13 000 moles of acrylamide. [2]

(iv) A student comments that the percentage by mass of nitrogen in acrylamide is the same as that in polyacrylamide. Explain why the student is correct. [2]

- (b) Acrylamide reacts with water to form acrylic acid and ammonium ions. The structural formula of acrylic acid is shown in the figure below. It forms compounds called acrylates.



- (i) Acrylic acid is a weak acid. [1]
How can Universal Indicator show that acrylic acid is a weak acid?

- (ii) Acrylic acid reacts with ethanol to make an ester. [1]
Draw the structure of this ester.

- (iii) Deduce the name of this ester. [1]

- (iv) Acrylic acid reacts with aqueous bromine. [1]
Draw the structural formula of the product of this reaction.

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Answers

Organic Chemistry Test 5.0

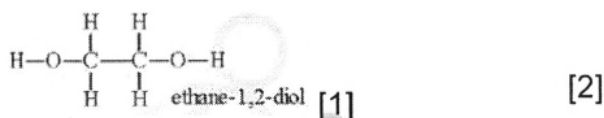
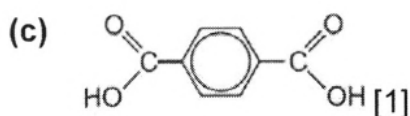
Q1

(a) 1000 [1] [1]

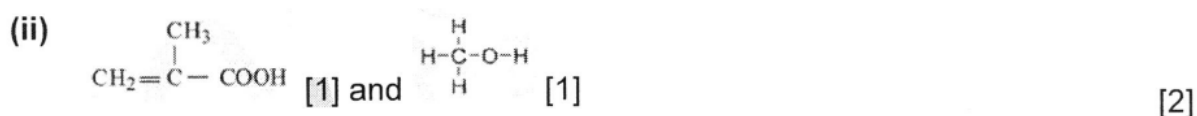
(b)

	true	false
D is a polyester.		√
Water is formed as a by-product when monomers react to form A and B.	√	
The empirical formula of C is the same as its monomer.	√	
One of the monomers that react to form B is an alcohol.		√

4 √ : [2] [2]
 1-3 √ : [1]



need to show all bonds, including -O-H bond



(iii) Warming/heating with concentrated sulfuric acid [1] [1]

(e) Disadvantage: Polymer can only be disposed off by burying in landfills which will lead to land or air pollution.[1]

Advantage: Polymer is durable and resistant to corrosion. [1] [2]

Q2

- (a) (i) Cracking [1]
 Mixture of aluminium oxide and silicon(IV) oxide catalyst [1] [2]
- (ii) Add samples of A and B to aqueous bromine. [:]
 If reddish brown aq. bromine decolourises rapidly, sample is A,
 If aq. bromine remains reddish brown, sample is B.
 3; [2]
 1-2; [1] [2]
- (iii) $C_4H_{10} \rightarrow CH_4 + C_3H_6$ [1] [1]
- (b) Add acidified potassium manganate(VII) and warm the mixture [1]
 If acidified potassium manganate(VII) remains purple, C is 100% converted to D [1] [2]
- (c) (i) M_r of B(propene) = 42
 Number of monomers = $33600/42 = 800$ [1]
- (ii) Similarity:
 Same empirical formula as the monomer. [1]
 Difference:
 Monomer is unsaturated while polymer is saturated [1] [2]

Q3

a	cracking	1
b	heat, 60 atmospheric pressure and phosphoric (V) acid any 2 (1m each)	2

Q4

a	sodium carbonate/sodium hydrogencarbonate	1
b	propyl ethanoate [1] concentrated sulfuric acid [1]	2
c	Ethanol [1] add acidified potassium manganate(VII), [0.5] reflux/heating [0.5]	2
d	$CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(l)$	2

Q5

a	i	$\left[\begin{array}{c} \text{H} \quad \text{CONH}_2 \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \right]_n$	1
	ii	Addition Polymerisation	1
	iii	<p>Mr of acrylamide = $12 \times 3 + 5 \times 1 + 16 + 14 = 71$ [1] Mass of 13 000 moles of acrylamide = maximum mass of polyacrylamide that can be formed = $13\,000 \times 71$ = 923 000 g [1]</p>	2

	iv	<p>The calculation for both the monomer and polymer is based on the formula of the monomer, same empirical formula [1]</p> <p>There are no other molecules being eliminated or produced OR All the elements in the monomers become the polymer product. [1]</p>	2
b	i	When it shows colours of yellow and orange	1
	ii	$\begin{array}{c} \text{H} \quad \quad \quad \text{O} \\ \diagdown \quad \quad \quad \\ \text{C} = \text{C} - \text{C} - \text{O} \text{C}_2\text{H}_5 \\ \diagup \quad \quad \quad \\ \text{H} \quad \quad \quad \text{H} \end{array}$	1
	iii	Ethyl acrylate	1
	iv	$\begin{array}{c} \text{H} \quad \quad \quad \text{COOH} \\ \quad \quad \quad \\ \text{H} - \text{C} - \text{C} \\ \quad \quad \quad \\ \text{Br} \quad \quad \quad \text{Br} \end{array}$	1