

Test 1: Identification and Production of Materials I

Total 30 marks (Suggested time 45 minutes)

Directions to students

- Answer the following questions on your own paper.
- Part A contains 5 multiple-choice questions, each worth 1 mark. Select the alternative A, B, C or D that best answers the question.
- Part B contains 5 short answer and longer response questions.
- You may use the standard formula sheet supplied.

PART A

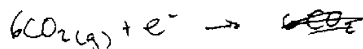
1. The synthetic polymer poly(ethene) is used in cling film. The transparent and flexible nature of cling film is most likely due to polymer chains which are
 - (A) unbranched and far apart.
 - (B) branched and joined by dispersion forces.
 - (C) unbranched and joined by polar bonds.
 - (D) branched and joined by hydrophilic and hydrophobic forces.
2. One of the best known condensation processes was discovered by Wallace Carothers in 1932 when he made nylon. The two compounds Carothers used to make nylon were adipic acid and a diamine. The products of the reaction would have been
 - (A) nylon alone.
 - (B) nylon and water.
 - (C) nylon, adipic acid and a diamine.
 - (D) nylon, adipic acid, a diamine and water.
3. The table below contains information about two organic compounds.

<i>Compound</i>	<i>Molecular weight</i>	<i>Boiling point (°C)</i>
Ethanol	46	78.3
Chloroethane	65	12.5

The better solvent would be

- (A) chloroethane, because it has dispersion forces between molecules.
- (B) chloroethane, because it has the higher molecular weight and is very volatile.
- (C) ethanol, because the high boiling point indicates strong forces between molecules.
- (D) ethanol, because of its polar nature and ability to form hydrogen bonds with other molecules.

4. Ethene can be used to produce compounds that are useful in industry. Ethene reacts more readily than ethane with substances such as bromine because
- (A) the double C=C bond in ethene requires electrons and the single C-C bond in ethane does not.
 - (B) the double C=C bond in ethene is longer than the single C-C bond in ethane.
 - (C) the double C=C bond in ethene is more reactive than the single C-C bond in ethane.
 - (D) ethene is denser and more volatile than ethane.
5. Only 5% of ethanol used industrially is produced by fermentation. Which statement about fermentation is correct?
- (A) Fermentation is an efficient way to produce alcohol.
 - (B) Yeast cells use the process of fermentation to provide energy.
 - (C) Ethanol and oxygen are produced by fermentation of cellulose.
 - (D) Fermentation of ethanol produces more energy than the combustion of ethanol.



PART B

Marks

Question 6 (6 marks)

Vinyl chloride and styrene are monomers used to make polymers. They have very different properties.

- (a) Draw the structure of one of these monomers. 1
- (b) Name and give a use for the polymer made from each monomer. 1
- (c) Account for the uses of these polymers in terms of their properties. 4

Question 7 (3 marks)

Sulfuric acid is used as a catalyst in many organic reactions.

- (a) Describe the role of a catalyst. 1
- (b) Write a chemical equation for the production of ethanol using sulfuric acid as a catalyst. 1
- (c) Write a chemical equation for the production of ethene using sulfuric acid as a catalyst. 1

Question 8 (4 marks)

In this module you performed a first hand investigation to determine and compare the heats of combustion of at least three liquid alkanols per gram and per mole.

- (a) Define the molar heat of combustion. 1
- (b) Describe how the accuracy and reliability of your investigation could have been improved. 2
- (c) If 0.46 grams of ethanol was used to increase the temperature of 200 mL of water by 16.3°C, calculate the molar heat of combustion of ethanol. 1

The specific heat of water is $4.18 \text{ J K}^{-1} \text{ g}^{-1}$.

Question 9 (7 marks)

- (a) Describe a process used to produce a named biopolymer. Name the specific enzyme or organism used to synthesise the material and account for the use or potential use of the biopolymer in terms of its structure. 5
- (b) Assess the impact of biopolymer research on the environment. 2

Question 10 (5 marks)

Marks

Petroleum is a source of fuel and raw materials for polymers. Plant materials or biomass are a potential source of substances currently obtained from petroleum.

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| (a) Identify a method for the production of ethene from petroleum. | 1 |
| (b) Outline a possible method of producing ethene from biomass. | 2 |
| (c) Discuss the potential of using biomass as a raw material. | 2 |