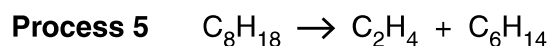
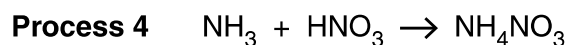
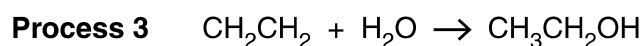
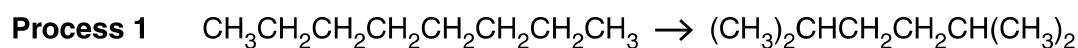


- 4 Atom economy and percentage yield are important factors in deciding the sustainability of a manufacturing process.

(a) Complete the expression below for atom economy.

$$\text{atom economy} = \frac{\text{sum of } \dots\dots\dots}{\text{sum of } \dots\dots\dots} \times 100\% \quad [1]$$

(b) The following five reactions all represent important industrial processes.



(i) Which process is an example of cracking?

..... [1]

(ii) Which process makes a structural isomer of the reactant?

..... [1]

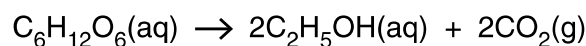
(iii) Which process does **not** have an atom economy of 100%?

Explain your answer.

.....

 [2]

- (c) The manufacture of ethanol by the fermentation of glucose can be represented by the following equation.



The atom economy is 51.1% and the percentage yield is 88.6%.

- (i) Suggest **two** reasons why it is a good idea to find uses for the carbon dioxide produced.

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..... [2]

- (ii) Some scientists believe that it is more important to have a high percentage yield in fermentation but others think that a high atom economy is more important.

Is it more important to have high percentage yield or a high atom economy in fermentation?

Explain your answer.

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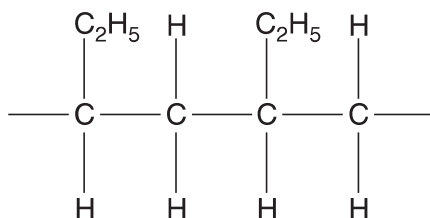
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..... [2]

[Total: 9]

- 6 Plastics contain polymer molecules. The disposal of waste plastics is causing many environmental problems. In the middle of the Pacific Ocean, there is a huge area of sea water contaminated with very small pieces of plastic waste. In some parts of the Pacific Ocean, there are as many as one third of a million of small pieces of plastic waste per square kilometre of ocean.

(a) A short section of one of the polymers found in the Pacific Ocean is shown below.



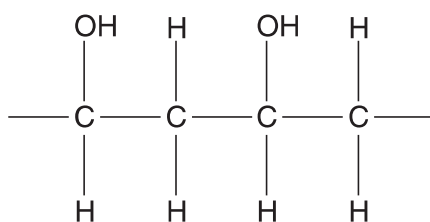
- (i) Name and draw the structure of the monomer used to produce this polymer.

name of monomer:

structure:

[2]

- (ii) The short section of poly(ethenol) is shown below.



Large quantities of poly(ethene) and poly(ethenol) are disposed of each year.

Poly(ethene) is found as a waste plastic in the Pacific Ocean but poly(ethenol) is not because it slowly dissolves in water.

Suggest why poly(ethenol) dissolves in water.

.....

 [2]

- (b) One way of disposing of poly(chloroethene) is incineration.

This process can cause environmental damage. Incineration produces a mixture of carbon dioxide, carbon monoxide and hydrogen chloride.

Carbon dioxide can cause climate change because it is a greenhouse gas.

- Describe examples of environmental damage that may result from carbon monoxide and hydrogen chloride.
- Outline the methods developed by chemists to reduce environmental damage caused by incineration.

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..... [4]

- (c) Explain why it is important to establish international cooperation to reduce the pollution levels of waste plastics.

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..... [2]

[Total: 10]