

# ETHENE AND POLYMERS

Syllabus reference 9.2.1

- 1 Complete the following table to identify the products of reactions of ethene and the uses of these products.

REACTANTS	PRODUCTS	USES
$\text{CH}_2=\text{CH}_2$ + water + catalyst		
	ethylene oxide	
	ethylene glycol (1,2-ethanediol)	
		monomer for making PVC, poly(vinyl chloride)

- 2 Complete the following statements using the words from the list below.

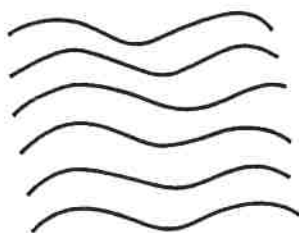
low density      polymer      branching      polymerisation      pressure  
 unbranched      addition      polyethylene      thousand      temperatures  
 monomers      double      catalyst

- a A chemical reaction in which many small molecules, called \_\_\_\_\_, combine together to form one large molecule is called \_\_\_\_\_. The large molecule is called a \_\_\_\_\_.
- b An \_\_\_\_\_ polymer is formed by molecules adding together without the loss of any atoms. For this type of polymer to form, the basic unit must contain a \_\_\_\_\_ bond.
- c When ethene polymerises it forms the polymer \_\_\_\_\_ which consists of a few hundred to a few \_\_\_\_\_ monomer units. Another name for this polymer is polyethene.
- d There are two processes used to form polyethylene. The older process uses high pressures, high \_\_\_\_\_ and an initiator. The alkane chains produced in this process cannot pack

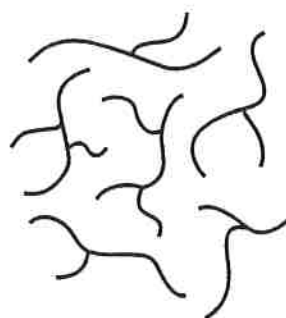
closely together in an orderly way because of the amount of chain \_\_\_\_\_. This product is called \_\_\_\_\_ polyethylene.

e The newer process uses lower temperature and \_\_\_\_\_ than the older process because it relies on a \_\_\_\_\_ to promote the reaction. This Ziegler-Natter process forms \_\_\_\_\_ chains which are able to pack more closely together in an orderly fashion. This product is called high density polyethylene.

3 The arrangement of long chain molecules in (a) high density and (b) low density polyethylene can be represented as shown below. Low density polyethylene has many side chains which prevent the molecules packing closely together, while high density polyethylene is more rigid and does not soften at temperatures below 100°C.



(a) High density



(b) Low density

a Explain what causes the difference in density between the two types of polyethylene.

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b Which form would you expect to have the greater mechanical strength? Give your reasons.

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c Which type would be more suitable for the following applications:

i a washing up bowl \_\_\_\_\_

ii a cordial bottle? \_\_\_\_\_

d Explain why a shopping carrier bag made from polyethylene is a greater hazard to the environment than a paper one.

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4 Complete the following table.

POLYMER	NAME OF MONOMER	STRUCTURE OF MONOMER	COMMON USES	IMPORTANT PROPERTIES RELATED TO USE
low density polyethylene (polyethene)				
high density polyethylene (polyethene)				
poly(vinyl chloride) PVC				
polystyrene				

5 The following items are man-made from a polymer rather than the traditional material listed. Complete the table below giving one advantage and one disadvantage of the new material over the old.

ITEM	OLD MATERIAL	NEW MATERIAL	ADVANTAGE	DISADVANTAGE
drain pipe	ferrous material	poly(vinyl chloride)	does not corrode	not as strong or tough
carrier bag	paper			
packaging	straw			
carpet	wool			
electrical wiring insulation	rubber			
soft drink bottles				