

Worksheet 13.1

A summary of polymer types

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CLASS:

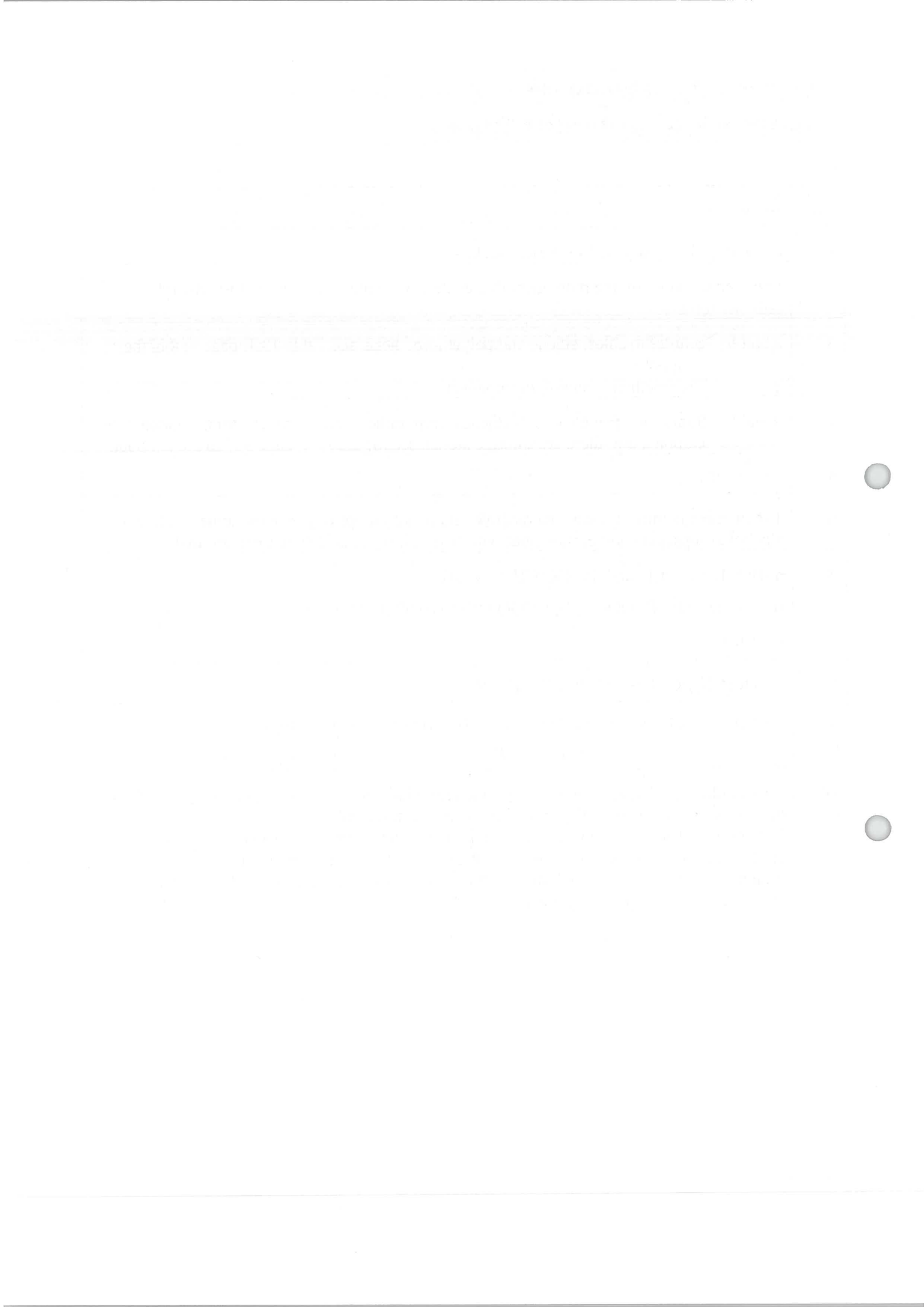
INTRODUCTION

This worksheet is designed to help you investigate polymers.

No.	Question	Answer
1	Draw a molecule of ethene, and draw the structure of polyethene.	
2	What is addition polymerisation?	
3	<p>a Draw a structural diagram of the monomer CH_2CHBr.</p> <p>b Draw the polymer it will form.</p> <p>c Name the monomer and the polymer.</p>	
4	<p>a Draw tetrafluoroethene.</p> <p>b Draw a section of the polymer formed when tetrafluoroethene polymerises.</p>	
5	<p>A section of a polymer is shown below. Draw the monomer used to make it.</p> $\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ & & & \\ \text{H} & \text{C} & \text{H} & \text{C} \\ & & & \\ & \text{N} & & \text{N} \end{array}$	
6	To form a condensation polymer, what property must the monomers possess?	

Worksheet 13.1**A summary of polymer types**

7	<p>a Draw a molecule of propane-1,3-diol and butanedioic acid.</p> <p>b Draw a portion of the polymer that would form between these two monomers.</p> <p>c What other product, apart from the polymer, would be formed in this reaction?</p>	
8	<p>Give the structural formulas of the monomers used to form the following polymer:</p> $\left(\begin{array}{c} \text{O} \\ \parallel \\ \text{C} \\ \parallel \\ \text{O} \end{array} (\text{CH}_2)_3 \begin{array}{c} \text{C} \\ \parallel \\ \text{O} \\ \parallel \\ \text{O} \end{array} (\text{CH}_2)_2 \right)_n$	
9	<p>Condensation polymers can also form between diamines and dicarboxylic acids. Draw a portion of the polymer formed from the reaction of the following monomers:</p> <p>$\text{H}_2\text{N} - \text{CH}_2 - \text{CH}_2 - \text{NH}_2$ and $\text{HOOC} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{COOH}$</p>	
10	<p>Two terms that are often used to describe addition polymers are 'thermosetting' and 'thermoplastic'. Use the Internet, or reference books to discover what these terms mean. Give several uses we make of thermosetting polymers.</p>	



Worksheet 13.3

Choice of polymer

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INTRODUCTION

There are over 5000 commercial polymers on the market. Why so many? Polyethene is the cheapest. Why not make all products from it? Standard polyethene is cheap. Any plastic product that requires no special properties can be made from polyethene. It does, however, have limitations. Polyethene has a relatively low melting point and it is not particularly strong. Once it starts to burn, it burns vigorously. Some products have requirements where these properties limit the use of polyethene. When this is the case, the manufacturer must consider polymers with more specialist properties. These are always more expensive. Carry out some research to provide the answers for the questions in this worksheet.

No.	Question	Answer
1	High-density polyethene (HDPE) is labelled as polymer number 2. What household items can you find made from HDPE?	
2	Are any of the items that you found for question 1 likely to be subject to high temperatures in normal use?	
3	What happens when a plastic garbage bag gets near a flame, but not in the flame? (Test this carefully, under adult supervision, if you need to.)	
4	Why are baby bottles not made from polyethene?	
5	What polymer is used to make 2 L ice-cream containers? These are not subject to heat, yet they are not made from polyethene. What weakness in polyethene does this highlight?	
6	Cordial containers are generally not suitable for use as soft-drink containers. Why is this?	

Worksheet 13.3

Choice of polymer

7	Nylon is a useful fabric for raincoats, but it is very unpopular in underwear with athletes. Why is this?	
8	Some polymers are considered safer than others for children's pyjamas. What property is this judgement based upon?	
9	Teflon is used for both frying pans and irons. What special properties does Teflon have?	
10	Polystyrene is very hard, but it is not suitable for tennis racquet frames. What property limits its use in this case?	
11	PVC is used for electrical fittings. What properties does it have that lead to this use?	
12	Find another example of the use of a specific polymer. Indicate why that particular polymer has been chosen for the use described.	

Worksheet 13.3: Solutions**Choice of polymer**

No.	Answer
1	Examples include 2 L milk bottles, and detergent and shampoo bottles.
2	No, HDPE has a low melting point.
3	The bag softens very easily and shrinks considerably, and eventually burns vigorously.
4	Polyethene baby bottles would lose their shape when being sterilised.
5	Ice-cream containers are made from polypropene. Polyethene becomes brittle at low temperatures; polypropene does not.
6	They will not withstand the pressure of the soft drink.
7	Nylon does not 'sweat', so moisture cannot escape from the skin.
8	Polymers that burn vigorously and form sticky blobs are not suitable for pyjamas.
9	Teflon has a high melting point and low coefficient of friction.
10	Brittleness
11	PVC has very low conductivity and also extinguishes itself.
12	Many possible answers for this question.

