















































# **MYSTERY** PLASTICS

Some plastic items do not have a symbol on them, so they have to be tested to see if they can be recycled.

The results of four plastics that have been tested are below.

Use the *Plastic sorting key* to help identify each of the four mystery plastics.





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## PLASTIC SORTING KEY





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CHALLENGE



# **IDENTIFYING** PLASTICS

- 1 Look for the symbol moulded on the plastic items and complete the first column in the table.
- **2** Using scissors, cut pieces of plastic approximately 5cm<sup>2</sup> from each plastic item.
- 3 Carry out the tests and record your results in the table below.

SAMPLE	Is there a symbol moulded on the plastic item? If so draw it below.	What is the full name of the plastic? Use the plastic information chart to help you.	Is it translucent, transparent or opaque?	What happens when you bend it? Is it flexible or is it stiff and difficult to bend?	What happens when you scratch it? Does it cut cleanly or are there white marks along the cut?	Does it float in water?
1						
2						
3						
4						



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Polymers are huge molecules, made from thousands of atoms.

They are made by joining together thousands of small reactive molecules called monomers.

The reaction is called POLYMERSATION.

In addition reactions, the double bond in the monomer (between the carbon atoms) opens up and neighbouring monomers join end to end.



In addition reactions, the polymer is the only thing that is formed.





## CHEMISTRY OF PLASTICS CHEMICAL FORMULA'S



Cut out the chemical formula, molecular structure, compound names, name of plastic, uses, and recycle code cards from the sheets.

Can you match the each of the six plastics with their relevant cards?







## CHEMISTRY OF PLASTICS MOLECULAR STRUCTURE







## CHEMISTRY OF PLASTICS COMPOUND NAME









## CHEMISTRY OF PLASTICS TYPE OF PLASTIC





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## CHEMISTRY OF PLASTICS RECYCLE CODE





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# CHEMISTRY OF PLASTICS





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# PLASTICS INFORMATION CHART



Symbol	Uses	Type of plastic	Compound name	Formula	Molecular str	ucture
	Engineering polymers are used in bonnet parts, window wiper holders and exterior mirrors for cars.	Polyethylene terephthalate also know as polyester	Polyethylene terephthalate or Poly(ethylene terephthalate)	(C <sub>10</sub> H <sub>8</sub> O₄) <sub>n</sub>		
23	Chemical drums, jerricans, toys, picnic ware, cable insulation, carrier bags and food wrapping material.	High density polyethylene (HDPE)	Polyethylene or polyethene or polythene or polythene	(C₂H₄) <sub>n</sub>	Rigid polymer structure	$ \begin{pmatrix} H & H \\ - & - \\ C & - \\ - & - \\ H & H \end{pmatrix}_{n} $
235	Window frames, drainage pipe, water service pipe, medical devices, automotive interiors and seat coverings, fashion and footwear, packaging, cling film and credit cards.	Polyvinyl chloride unplasticised polyvinyl chloride	Polyvinyl chloride or poly(1- chloroethylene)	C <sub>2</sub> H <sub>3</sub> CI) <sub>n</sub>		
	Squeeze bottles, toys, carrier bags, general packaging, gas and water pipes.	Low density polyethylene (LDPE)	Polyethylene or polyethene or polythene or polythene	(C₂H₄) <sub>n</sub>	Branching polymer structure	$\begin{pmatrix} H & H \\ - & - \\ C - C \\ - & - \\ H & H \end{pmatrix}_{n}$
253	Coffee pot and washing m/c parts (where high temperature and moisture are critical).	Polypropylene (PP)	Polypropylene or (polypropene)	(C₃H₅) <sub>n</sub>		$ \begin{array}{c} \left( \begin{array}{c} H & CH \\ - & -H \\ C - C \\ - & -H \\ H & H \end{array} \right)_{n} \end{array} $
6	Toys and novelties, rigid packaging, refrigerator trays and boxes, cosmetic packs and costume jewellery.	General purpose polystyrene (GPPS)	General purpose polystyrene or Poly(1- phenylethylene)	(CଃHଃ)n		$\begin{pmatrix} H & H \\ - & - & - \\ - & - & - \\ - & - & - \\ H & - $





## **WASTE** TIMELINE

Cut out the cards below and place them in the order from quickest to longest time it takes them to decompose.





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## **LIFECYCLE ANALYSIS** PICTURE CARDS

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Cut out the pictures and arrange them in a way that tells the story of a plastic drinks bottle.





PUPUL Name **LIFECYCLE** ANALYSIS Draw or write the name of the product you are 1. Raw materials and extraction: Which raw analysing in the middle box and answer the questions materials are used to make the product? about different stages in the product lifecycle. You can use pictures to illustrate your answers too. 2. Production: How is the material used in the 6. End of life: How can it be disposed of or product made? recycled? **PRODUCT: 3. Manufacture:** How is the product made? 5. Use: How is it used? 4. Packaging and distribution: How is the product packaged and distributed throughout its lifecycle?





Add one of the 4Rs Rethink, Reduce, Reuse, Recycle to match their definition.





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## ENVIRONMENTAL IMPACT OF PLASTIC

Cut out the cards and place them on your completed lifecycle analysis sheet in the areas where you think recycling plastics, rather than making 'new' plastics could reduce the impact on the environment. You might need more than one copy of the cards.





# CHALLENGE

# PLASTIC RECYCLING: TRUE OR FALSE?

Cut out the cards and decide which ones you think are true of false facts about plastic recycling.



Check out the following websites to see which facts are true or false or ask your teacher for the answers.

recycling-guide.org.uk/facts

recyclenow.com/facts-figures/how-it-recycled/plastic-bottles

ecoforce.co.uk/green-facts





## MAKING BIO PLASTICS



#### YOU WILL NEED

#### Ingredients

- 1.5 tablespoons corn starch
- 1 teaspoon vinegar
- 1 teaspoon glycerine
- 5 tablespoons of water
- Food colouring (optional)

#### Equipment

- 1 saucepan
- 1 wooden spoon
- 1 round edged knife
- A selection of pastry cutters or moulds to shape the plastic
- Non-stick baking sheets or greaseproof paper

Instructions of how to make bio plastics

- Place all the ingredients in a saucepan, including a few drops of food colouring if you want coloured plastic.
  Before heating, stir the ingredients until they are all combined.
- 3 Place the pan over a low heat and continue to stir until the mixture turns sticky and translucent.
- Allow the mixture to cool a little. Use a spoon to place the sticky mixture on a non-stick baking sheet or greaseproof paper.
- Use a knife to spread the mixture to the required thickness and leave to cool.
- Once cooled the bio plastic can be cut with pastry cutter and left to dry. Drying takes about 4-5 days.





Use the internet to help you find out about oil based and bio plastics. Record your finding below.

Oil based plastic	Questions	Bio plastic
	What is it made from?	
	Is it made from a renewable source?	
	What can you make from it?	
	How long does it take to decompose?	
	Can you recycle it?	
	What are the problems associated with it?	



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## NEPALESE WOMEN'S GROUP





## CONTEXT

The Hamro Mahila Women's Group in Nepal was set up after a group of women 'waste 'pickers were trained and supported by Practical Action in making crafts from 'waste' plastic. Their enterprise allows them to work in a safer environment whilst earning money.

Your challenge is to design a product that could be made by the women's group from locally found waste plastic. The women have the use of a sewing machine, iron and basic craft tools. The products need to be made cheaply whilst still being safe to use.

You need to decide whether this product will be sold locally or internationally in either case you will need to consider how this might affect the design characteristics.

For more information *bit.ly/practicalction-nepal* 

YOUNG ENTERPRISE



## CONTEXT

Your newly set-up young enterprise company have decided to take on 'The Fiver Challenge' which aims to create a mini business idea with a start-up fund of £5.

It is up to you what you use the £5 for but your product must:

- Reuse locally sourced plastic
- Engage with the community either in the creation of the product or its final use

You will need to consider your target market and your product branding. The retail price must reflect this.

You need to decide whether this product will be sold locally or internationally in either case you will need to consider how this might affect the design characteristics.

## **CHARITY**



## CONTEXT

The charity Practical Action are looking to broaden awareness of the work they do so want you to design a product that could be sold online at Practical Presents.

They would like the design to have a strong sustainability message so would like you to use plastic 'waste' that is easily available. The product should be cheap to make but safe to use and have a high quality finish.

Your prototype can be handmade but you will need to consider how it could be produced on a large scale.

You will need to consider the target market, the charity branding and also what will happen to any profits made.

For more information *practicalaction.org/ buy-a-practical-present-1* 



# WHO IS MY PRODUCT AIMED AT?

Before starting to develop ideas for your product, it's important for you to decide who you are developing your product for.

- Have a look at the four profiles of different groups of people, and decide whether you would like to select one of these or develop a new target group.
- Once you've chosen a group, you can begin to mind map and research ideas for products that meet your users' needs.





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## WHAT'S THE SPECIFICATION? IDEAS FOR DESIGN CRITERIA



As a group choose your top 5 criteria for how you want your product to be, then decide if you want to add in any others of your own.









Here are a few ideas to help you get started with developing your ideas for reusing plastics.

### **Reusing plastic bags**

Cut out simple shapes from carrier bags, layer and stitch or glue them together to make a new material to make into a range of products.

## Using strips of plastic

- Use scissors to cut strips from different coloured carrier bags. For knitting make a continuous long strip from one bag.
- Have a go at knitting, weaving, plaiting or making a pom-pom with the strips.

### **Fusing plastic**

Experiment with cutting plastic bags into a range of shapes or plaiting plastic strips before heating them with an iron or heat press to form a new plastic material. What products could you make using these techniques?

- If you are using an iron, make sure you use baking paper on both sides of the plastics and set the iron on a medium heat.
- If you are using a heat press, experiment with heat settings of around 130°C for 10seconds.

















# WHAT CAN I DO WITH PLASTICS?



## Ideas with plastic packaging

Have a go at using a shaped puncher or scissors to cut repeat shapes from colourful bottles or packaging. They could be used to make jewellery or to decorate a product.





Use scissors and shape punchers to cut interesting shapes into plastics bottles to use for storage or useful products.



### Links to designers who reuse plastics

The Meta picture *bit.ly/reuse-plastic-ideas* 

Jessica Perry bit.ly/reuse-plastic-jessica-perry

Sandra Guerreiro bit.ly/reuse-plastics-sandra-guerreiro

Florie Salnot *bit.ly/reuse-plastics-florie-salnot* 





# MAKING A NOTEBOOK

### How to make a notebook



## **YOU WILL NEED**

- Card from a cereal box
- Plastic bags in a range of colours
- PVA glue or double-sided sticky tape
- Ruler
- Pen
- Scissors
- Iron and baking sheets
- Heat press (optional)

- Measure out and cut a piece of cardboard that is a good size to fold to form a front and back cover for the booklet.
- Add a spine width of 1cm in the centre to allow the booklet to close when folded.
- 3 Score along either side of the spine to fold.
- 4 Make your plastic covering for the booklet
- 5 This can be done using the heating plastic bags technique you have already practised.
- 6 Cut the plastic to a size that will cover the card, allowing enough space to fold the plastic inside the card cover.
- Place double sided tape or glue around the edges of the inside of the cardboard. Place the card on top of your plastic and pull the edges over tightly to stretch it over the cardboard insert.
- Trim the edges to neaten up.
- If you would like ties on your booklet, plait 3 strips of carrier bag to make them. Fasten these with tape at either end of the booklet.











- Cut out and fold the edges over about 1 cm.
- Using glue or double sided tape 12 place the plastic onto inside of notebook cover to neaten the appearance.
  - To finish your booklet, secure sticky notes or paper onto the inside cover. Fold over and tie plaits to close the booklet.

### Enjoy your notebook!















### How to make plastic bunting



### YOU WILL NEED

- A selection of plastic bags
- Paper/card to make a template
- Pen
- Scissors
- Iron
- Heat press (optional)

- Use the fusing plastic technique to make some colourful plastics material for your bunting.
- 2 Develop a template design of your size and choice and cut it or them out of card.
- 3 Using the template and a biro draw as many shapes onto the plastic as you can fit and cut them out using scissors.
- Make a strip of plastic (approximately 2.5cm) wide by cutting a continuous long strip from a carrier bag.
- Space your plastic shapes along the strip and use either a sewing machine, strong glue or very carefully use an iron and baking sheets to melt your shapes onto the strip.

### **Enjoy your bunting!**











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## PRODUCT OUTLINE AND DESIGN CRITERIA



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### **Project title**

Outline your project title. Make sure you include:

What you are planning to design and make?

## Design criteria

Before developing your ideas for your plastic product, think about what's important for you to consider when designing your product.

Make sure you include ideas that reflect **who** you are designing for and **why** you are designing the product.

Once you have agreed on your criteria write them below and give each criteria a reason why it is important.

Our product will...

Who you are designing and making for

Why you are designing and making the product (its purpose).





# PRODUCT DESIGN SHEETS DESIGN IDEAS

Develop your ideas for your plastic product and sketch them below.

Annotate your design ideas with notes and examples of the techniques that you have practised to give additional information to your designs.

If you are working in a group, share your design ideas. Consider which ideas, or which parts of your ideas best meet the design criteria. As a group decide which idea to take forward as your final design idea that you might choose to make.



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# PRODUCT DESIGN SHEETS

Present a final design drawing of your group's idea with annotations to explain its features.



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## PRODUCT DESIGN SHEETS PRODUCT PLAN

Use as many boxes as you need to produce a step by step plan of how to make your product. Don't forget to include information about the materials and equipment you need.





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## **PRODUCT** EVALUATION



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# PLASTICS TO PROFIT

In the plastics challenge so far, you've focused on developing your new product. Now, it's time to start thinking about how to market and sell the product.

Earlier in the challenge you've learnt about the 4R's (Rethink, Reduce, Reuse and Recycle), but when it comes to marketing products, you need to think about the 4 P's (Product, Place, Price and Promotion).

Use the questions below to help your group think through and plan your marketing strategy.



When you've thought through your ideas, work as a team to develop your marketing and for selling plans your product.

Don't forget to decide what you are going to do with the profits you make!



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