

Controlled Assessment Science A

Replacing plastic bags with more ‘environmentally-friendly’ alternatives

Case Study

Information for teachers

There is one document provided for candidates for each Case Study task:

- **News Sheet** – a collection of several articles about a topical issue in science, which will form the basis of the Case Study. It should be issued to candidates at the start of the task.

Information for teachers

Specimen Controlled Assessment task for the Case Study:

Replacing plastic bags with more 'environmentally-friendly' alternatives

These notes provide background information for the preparation of candidates for this task and advice on the assessment of the Case Study report.

Reference should also be made to Section 5 of the specification for Science A and the *Guide for controlled assessment for GCSE Twenty First Century Science*.

General guidance for teachers

Task setting is under high control. Real tasks are therefore set by OCR, but in this case a sample task has been provided by OUP to allow you to prepare your students. Case Study tasks offer opportunities for contextualisation to take account of local circumstances including topical issues and the needs of candidates. However, assessments must be based on the published marking criteria (within Section 5 of the specifications). If there is any doubt about whether a contextualised task still sufficiently matches the criteria, centres should seek confirmation from OCR that the task is still valid.

Preparation of candidates

It is expected that before candidates attempt this controlled assessment task they will have received general preparation in their lessons. Learning activities to develop the relevant skills should have been provided and the broad requirements of the assessment made clear to candidates.

Ideas about synthetic and natural polymers are introduced in specification Module C2 *Material choices*, and provide the scientific background that candidates will need to have covered before starting the Case Study controlled assessment.

Assessment of the quality of written communication (QWC)

The quality of written communication is assessed in Strand B of this controlled assessment task. Candidates should be advised that their quality of written communication will be assessed. Further information about the assessment of QWC may be found in the specification.

Guidance on assessment

All assessment of the Case Study task is based on the final report submitted by the candidates.

The marking procedure and marking criteria are described in detail within Section 5 of the specifications. Marking decisions should be recorded on the respective cover sheets (available to download from www.ocr.org.uk and included in the *Guide for controlled assessment for GCSE Twenty First Century Science*). Candidates' reports should be annotated to show how marks have been awarded in relation to the marking criteria.

Teachers should note that in the live assessment, candidates will be expected to develop their own approaches in order to access the full range of marks.

Additional guidance on marking criteria

Strand B

In this strand, the mark descriptors relate to how well relevant science knowledge is used to explain the topic or to analyse and interpret scientific evidence which underpins claims. Thus, it is necessary to think first about what science knowledge or principles are available to candidates, then use the mark descriptors in relation to this, since different candidates may have chosen different questions to study. For marking strand B, the first stage is therefore to identify the science knowledge and principles which will be relevant to the particular Case Study. Once the relevant body of information is established, the mark descriptors can be interpreted in relation to it.

Strand C

For strand C, the framework for applying the mark descriptors is defined by the particular sources and information which the candidate has used in the study. Marking should reflect the quality of decision-making in relation to the information which has been used.

Strand C Aspect (b)

This is a very complex area. There are many advantages and disadvantages of using plastic bags and their alternatives, including bags made from paper, cotton and from bioplastics such as polylactic acid. Thus, the conclusions reached by different candidates will not all be the same. Marks awarded should be based on how well the conclusion is linked to the evidence seen by the candidate, i.e. there is no single 'right' answer.

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Case Study

News Sheet

Background information:

This News Sheet contains some reports about different people’s views about:

Replacing plastic bags with more ‘environmentally-friendly’ alternatives.

The articles give information about some of the research that has been done, and some of the opinions which have been published. The people who wrote the articles do not all agree about whether plastic bags should be replaced with more ‘environmentally-friendly’ alternatives.

Read the articles and then choose a question for your Case Study that interests you about the replacement of plastic bags with more ‘environmentally-friendly’ alternatives.

Your report must show clearly where your information has come from.

References:

- [1] New Scientist. *Battle of the bag*, 11 September 2004 by Caroline Williams
<http://www.newscientist.com/article/mg18324644.800-battle-of-the-bag.html?full=true&print=true>
Accessed 2 May 2011
- [2] The Guardian *‘Sustainable’ bio-plastic can damage the environment* by John Vidal
<http://www.guardian.co.uk/environment/2008/apr/26/waste.pollution/print> Accessed 3 May 2011
- [3] The Independent *Plastic fantastic! Carrier bags ‘not eco-villains after all’* by Martin Hickman
<http://www.independent.co.uk/environment/green-living/plastic-fantastic-carrier-bags-not-ecovillains-after-all-2220129.html?service=Print> Accessed 3 May 2011
- [4] New Scientist *Please scoop the poop into the doggy bag*, 25 April 1998 by Alison Motluk
<http://www.newscientist.com/article/mg15821313.600-please-scoop-the-poop-into-the-doggy-bag.html> Accessed 3 May 2011
- [5] British recycled plastics web site <http://www.britishrecycledplastic.co.uk/> Accessed 3 May 2011
- [6] BBC News website *Shop bags’ 7p levy set for 2011 says Welsh minister*, 4 June 2010
<http://www.bbc.co.uk/news/10227459> Accessed 3 May 2011

Battle of the bag

For many green campaigners, the plastic bag has become public enemy number one. Used bags litter the streets, fill up landfill sites and block drains. And that's not all. As well as being a danger to babies and children, plastic bags kill wildlife. A dead whale found on a French beach had 800 kg of plastic bags and other packaging in its stomach.

In the UK, we use between 9 and 17 billion plastic bags a year. Environment campaigners argue that we don't really need them. "Their manufacture wastes precious fossil fuels. A bag is typically used for just 12 minutes before being thrown away," points out a campaigner.

All over the world, plastic bags are both loved and hated. Globally, we use up to a trillion every year. But discarded bags don't look good, especially flapping in trees. The Irish call them 'witches' knickers', and in South Africa they are known as the 'national flower'.

Many governments are fighting the plastic menace. Denmark started taxing carrier bags in 1994. Taiwan followed their example in 2001, charging 2p for a carrier bag. In 2002 Ireland introduced its 'PlasTax' on plastic bags. In two years the number of plastic bags used in Ireland reduced by 90%, and €23 million was raised for environmental projects.

But not everyone believes the battle of the bag is worth fighting. Plastic manufacturers point out that plastic bags are a hygienic, waterproof, robust and convenient way of carrying the shopping home. They say that 80% of plastic bags are reused as bin liners and nappy bags, for example. And, says the plastics industry, they are much more energy-efficient to manufacture and transport than heavier and bulkier alternatives like paper and cardboard.

Source: *New Scientist* [1]

Plastic recycling – how it works

1. At home, people collect plastic waste. They put it out for recycling, or take it to a recycling bank.
2. Lorries collect the waste.
3. At recycling factories, people separate different sorts of plastic by hand. They use the symbols on the items to help them. Scientists are developing ways of sorting it mechanically.
4. The different types of plastic are melted, separately. The liquids are poured into moulds to make new things.

Source: *Science text book*

Wales plans 7p bag levy

A 7p charge for plastic carrier bags is expected to be introduced in Wales in 2011.

Environment Minister Jane Davidson says the charge will cut the number of the bags being dumped in landfill sites, and will encourage shoppers to reuse their bags. She says the charge is a step towards reducing the carbon footprint of Wales, and will help to keep the Welsh countryside beautiful.

However, a spokesperson for the British Retail Consortium is against the charge, saying that the move will hit low-income families and be confusing for retailers and consumers.

Source: *BBC web site* [6]

Bioplastics can damage the environment

Supermarkets' efforts to replace oil-based plastics with bioplastics made from plants are damaging the environment and confusing consumers, according to a study by the Guardian newspaper.

Bioplastic manufacturers say their packaging materials make carbon savings of up to 80% compared to oil-based plastics, and can keep food fresh for longer. But there are growing concerns about the impacts of bioplastics.

Bioplastics are made from plants such as maize, sugar cane or wheat. The greatest worries are about those made from polylactic acid (PLA), produced from maize.

Most bioplastics end up on landfill sites. Here, bacteria break them down without oxygen. The process releases huge amounts of methane, a greenhouse gas which is 23 times more powerful than carbon dioxide. Some methane from landfill sites is captured, and used for heating or generating electricity. Much more escapes to the air.

Many people mistakenly put bioplastic waste into their recycling bins. But recycling companies say they need expensive new equipment to separate bioplastics from waste for recycling. The bioplastics themselves cannot be recycled – in the UK, they would simply be sent to landfill sites.

Finally, point out the Guardian researchers, bioplastics contribute to the global food crisis. The maize used to make bioplastic requires huge areas of land, which were previously used to grow food crops.

Source: *The Guardian* [2]

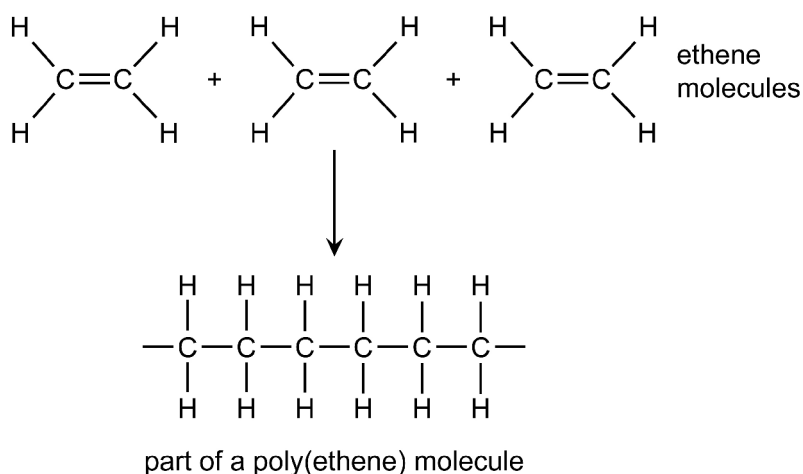
Polythene bags: the science beneath the packaging

Polythene is a polymer. Its properties make it useful. It is strong, flexible and durable – perfect for shopping bags!

Polythene molecules are made by joining together thousands of ethene molecules. Ethene molecules can join together because they have a double bond.

The diagram shows how the molecules join together to form long chains. Only a small part of the polythene molecule is shown. The reaction is an example of a polymerisation reaction.

Ethene is obtained from crude oil. Crude oil is a non-renewable resource.



Source: *a science textbook*

Inside bioplastics

We are proud to announce that our in-store butchers and fishmongers will no longer wrap your meat and fish in polythene. As from next month, they will be wrapped in biodegradable cornstarch bags.

The new bags are transparent and flexible, just like polythene bags. And, as you'd expect from your favourite supermarket, they will keep your food clean and fresh. But these bags have an added advantage – when buried in soil, tiny microbes help them to rot away. Our cornstarch bags are good for you, and good for the environment.



In depth from your favourite supermarket: making cornstarch

Our farmers plant maize seeds, providing them with nutrients from fertilizers as they grow. They transport the harvested maize to a factory, where natural starch is extracted from the maize. Next, special bacteria break down big starch molecules into smaller lactic acid molecules. Finally, thousands of lactic acid molecules join together in long chains. These are molecules of the cornstarch polymer, also called polylactic acid, or PLA for short.

Source: promotional material from a supermarket

Fantastic plastic – plastic bags not environmental disasters

Research carried out by the British government's Environment Agency, and reported in the Independent newspaper, suggests that polythene carrier bags are less damaging to the environment than supposedly greener choices like cotton or paper bags.

The Environment Agency did a life cycle assessment of supermarket carrier bags, aiming to find out which of seven types of bags has the lowest environmental impact. The scientists assessed the pollution caused by extracting raw materials, and by the production, transport, and disposal of the bags.

The scientists collected data and did calculations to show that a polythene carrier bag has a global warming potential of 1.57 kg CO₂ equivalent. A paper bag has to be reused four times to have a similar global warming potential of 1.38 kg of CO₂ equivalent. The researchers calculated that a cotton bag needs to be reused 171 times in order for it to have a global warming value similar to that of one polythene carrier bag.

The researchers concluded that the polythene bag had the lowest environmental impacts of the single use options in nine of the ten options studied. This is because it was the lightest bag.

Source: The Independent [3]

15-year old invents flushable dog poo bag

A Canadian teenager has invented a biodegradable dog poo bag from tissue paper and chewy sweets. It can be flushed down the toilet.

When walking his dog, James Robins-Early used to use plastic bags to 'scoop the poop'. But he worried about the plastic, and its impact on the environment. So he decided to invent his own dog poo bag.

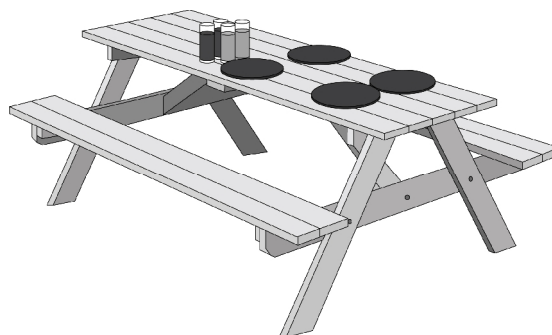
His first effort, made from tissue paper, wasn't strong enough for his own dog's poo. He used stitching to improve the design, and made a coating for the bag out of cornstarch, gelatine and icing sugar.

Source: New Scientist [4]

Construction and landscaping products made from 100% British recycled plastic

We sell...

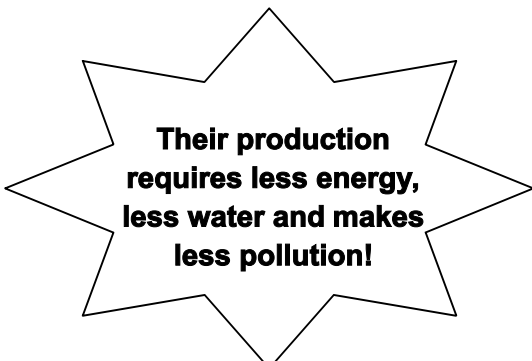
- Picnic tables
- Plant containers
- Traffic bollards



...and many other products, all made from **recycled plastic!**

Our products are...

- Durable
- Rot and algae proof
- Non slip
- Splinter free
- Vandal resistant
- Recyclable



**Their production
requires less energy,
less water and makes
less pollution!**

Source: British Recycled Plastic web site [5]