



# Science lesson 4

## – Answer sheet

## Lesson 4 – Answer sheet

**Learning aim:** To evaluate information and data to draw conclusions, present findings and develop an appreciation of sustainability.

You are the Head of Product at a large supermarket. You have been asked to do a presentation to the Sustainability Lead explaining which packaging material would be the best fit for your new luxury eco-spa toiletries range, and why. The range includes a handwash, soap and body lotion aimed at customers who are keen to use environmentally friendly products but can still buy the products at low cost.

In a group, you need to identify the pros and cons of the packaging you are analysing for both the customer and the environment. (You will be allocated to either glass, plastic or compostable packaging.) You are then going to present a pitch for your product to the Sustainability Lead. The whole group will then vote on which material to select for eco-spa toiletries.

Use all the information provided (which includes general information and data presented as graphs) to help inform your decision and pitch.

You need to think about:

- 1) Advantages to the environment.
- 2) Disadvantages to the environment.
- 3) Cost of transporting the packaging.
- 4) Cost of making the packaging.
- 5) Carbon footprint left by the packaging (CO<sub>2</sub> emissions).
- 6) How attractive the packaging looks.
- 7) How easy it is to make the packaging.

## Plastic

Plastic is not a natural material made by people so is called synthetic. It is a long molecule made of many repeated smaller parts, so it is called a polymer. In Greek “poly” means many and “mer” means part of.

Plastics are made from oil, coal and gas which are heated. When these are heated, they breakdown into different smaller parts called molecules which are then joined up again to make different plastics. Different combinations of molecules form different kinds of plastic.

### What are the positives and negatives of using plastic for packaging eco-spa?

Plastic used as packaging is very strong, flexible and lasts for a long time. Depending on what your packaging is for, plastic can be heated and made into many different shapes. It can also be produced at low cost.

Unfortunately, plastic is not biodegradable so does not break down. This means that when it has been used, it will stay in the environment. Plastic bags and bottles might be eaten by animals and fishing lines collect in the ocean and animals may eat them or be hurt if plastic fishing lines get wrapped around them, stopping them from swimming or eating.

Plastic is lightweight so it can be transported easily and cheaply from manufacturer to customer. This reduces costs.

Some plastics have chemicals in them that can get into what is contained within it (leach). This is a concern as it has been known to cause health problems. For makeup products, plastic is good as it is airtight and resistant to water, so nothing can get in and contaminate the products inside.

## Glass

Glass is made by heating sand with soda ash and limestone in a big oven called a furnace. When it is melted it can be moulded into shape. Windows are made by floating the melted sand on liquid metal. Glass is not a polymer because of the way the particles arrange themselves when the heated sand cools down. It is called amorphous.

### What are the positives and negatives of using plastic for packaging eco-spa?

Glass is good for packaging toiletries as it will not react with the contents of the package so the handwash etc. will be unaffected. It is also very strong and can be moulded into any shape for the product.

Whilst it is strong, glass is fragile and can crack, so liquids like handwash would leak out. It could also shatter totally, and this means there is a safety issue as it is sharp and can cut skin. This is particularly dangerous if the products are being used in the bathroom where shoes may not be worn.

The recycling of glass is well controlled. It is easy to recycle, and glass keeps its properties. Glass is not biodegradable.

Glass is heavy making it more expensive to transport so the cost of the toiletries will be more expensive. Glass packaging can look very attractive as bottles can be different colours and have designs within them to make the hand wash etc. more pleasing to a buyer. As glass is transparent, the buyer can see the product inside.

Glass is made from sand from the coast which can affect biodiversity and is expensive to make due to the sand collection and heat energy needed to melt it.

## Compostable packaging

Compostable packaging is packaging made from materials that will totally break down when left in the right environment. There are different ways of making compostable packaging, but they are all plant based. Examples are cornstarch packaging, bamboo, paper and card. There is even mushroom packaging! Once these have been used, they are turned into compost (which is added to soil to feed it) and used on the land. People can either do this at home or send the packaging to an industrial composting site. It does not need lots of heat energy to be made.

### What are the positives and negatives of using compostable packaging for packaging eco-spa?

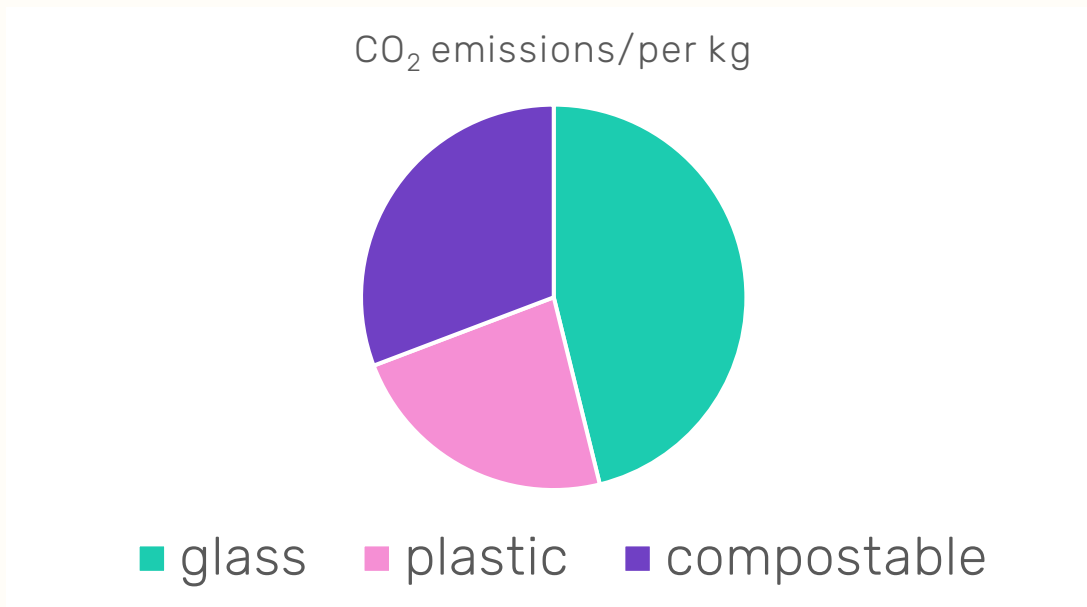
This type of packaging is called compostable because it benefits the soil when it breaks down. The elements within it are returned to the soil and can be used for plants to grow.

It does have to be used within 6 months or less. This eco packaging can be used to promote the eco-spa toiletries as even the packaging is totally natural which would help to promote the product to customers. Compostable material can sometimes be contaminated when people put the wrong waste in with the composting bins and this will affect how quickly and effectively the breakdown occurs. This type of packaging is water resistant. There is no need for landfill with compostable packaging.

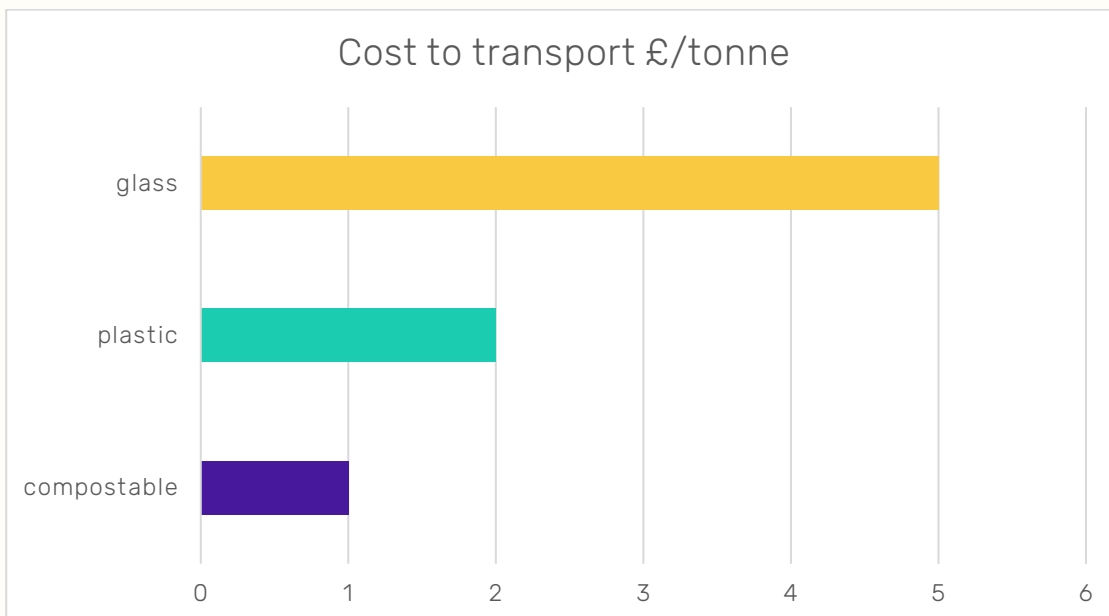
There are limited options for the disposal of compostable packaging as special industrial plants are needed to produce the compost in large amounts.

This packaging is one-time use only as once it is composted, it has been lost. Some compostable packaging is very thin and can rip easily during transport. Compostable packaging is cheap and lightweight, so there will be a lower cost involved in getting eco-spa products to the sellers.

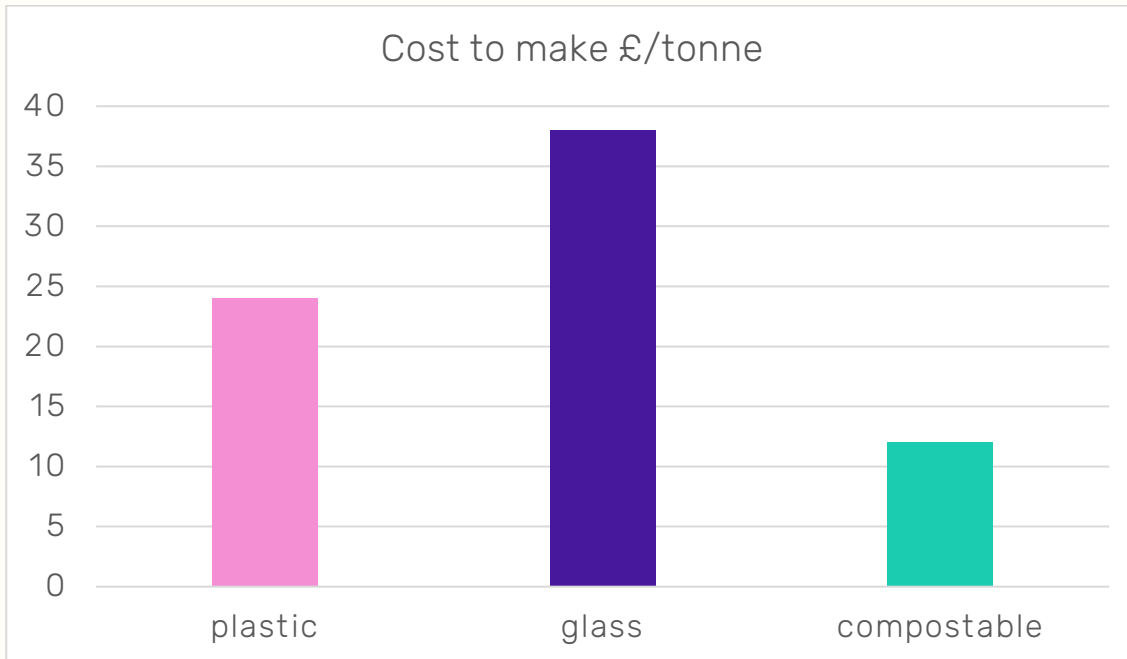
Graph 1 shows the amount of carbon dioxide gas per kg of each material given out during production.



Graph 2 shows the cost in pounds per mile to transport the different packaging.



Graph 3 shows the cost in pounds per tonne to make the different packaging.



Use the table below to make notes on the information you are going to present.

Name of material (plastic, glass or compostable packaging): PLASTIC

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#### Positives for environment

- Less CO<sub>2</sub> emissions per kg than glass AND compostable so less impact on global warming as CO<sub>2</sub> is a greenhouse gas.
- Cheaper to transport so less fuel used.

#### Negatives for environment

- Not a natural product.
  - Needs heat to make.
  - Not biodegradable.
  - Harms ocean life.
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#### Positives for customer

- Cheaper than glass to make so should make the product price cheaper.
- Strong unlike compostable.
- Will not break like glass if you drop it.
- Lasts for a long time.
- Lightweight so not heavy to post or carry in shopping.
- Airtight so products keep fresher for longer.

#### Negatives for customer

- Does not look as nice as glass.
  - Not sustainable.
  - Some chemicals in plastics can leach into the products inside the packaging so may contaminate the toiletries.
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Name of material (plastic, glass or compostable packaging): GLASS

#### Positives for environment

- Less CO2 emissions than compostable.
- Well controlled recycling.
- Less likely to cause pollution to environment than plastic.
- No evidence of ocean life being affected in same way as plastic.

#### Negatives for environment

- Most CO2 emissions per kg during production than plastic AND compostable so high impact on global warming as CO2 is a greenhouse gas.
- Not a natural product.
- Needs heat to make.
- Not biodegradable.
- Most expensive to transport so may impact on fuel used.
- If not disposed of properly could harm wildlife as sharp.
- Uses sand from coasts so affects biodiversity.

#### Positives for customer

- Looks attractive.
- Does not react with anything so products cannot be contaminated.
- Can see the products inside the packaging.
- Cheaper than glass to make so should make the price cheaper.
- Strong unlike compostable.
- Will not break like glass if you drop it.
- Lasts for a long time.

#### Negatives for customer

- Not sustainable.
- Brittle- breaks easily if dropped.
- Broken glass can be harmful, cause cuts.
- Heavier than compostable or plastic so heavy to post or carry in shopping.
- Most expensive to make so may add cost to the product.

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|---|---|
| <ul style="list-style-type: none"> <li>• Lightweight so not heavy to post or carry in shopping.</li> <li>• Airtight so products keep fresher for longer.</li> </ul> | <ul style="list-style-type: none"> <li>• Most expensive to transport so may add cost to the product.</li> </ul> |
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Name of material (plastic, glass or compostable packaging):  
COMPOSTABLE

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Positives for environment

- Less CO2 emissions than glass.
- Well controlled recycling.
- Natural product.
- Packaging can be composted once used so return nutrients to soil.
- Biodegradable.
- Cheapest to transport so less fuel used.
- No heat needed in production.

Negatives for environment

- Most CO2 emissions per kg during production than plastic AND compostable so high impact on global warming as CO2 is a greenhouse gas.
- Might be contaminated with the wrong waste which affects the time composting takes and the quality of it.

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Positives for customer

- Cheapest to make so should make the price cheaper.
- Sustainable.
- Lightweight so not heavy to post or carry in shopping.

Negatives for customer

- Packaging is weak and can tear easily.
  - Packaging must be used within 6 months so toiletries would have to be used.
  - Currently only limited option for recycling
  - Limited recycling may add to cost.
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