

Waste: time to move mountains

Numeracy

Each year the UK produces up to 300 million tonnes of waste. Waste from households accounts for about 30 million tonnes a year with each household on average producing one tonne of rubbish every year. That's the same weight as almost 5 million male African Elephants! Virtually everything we use creates varying degrees of waste throughout its lifecycle. There is waste associated with the extraction, harvesting, manufacture or transport of materials, waste associated with using a product, e.g. a car using oil, or a toy using batteries, and finally the negative impacts of waste disposal. The extraction of resources often impacts negatively upon Southern countries through mining or logging for example. Yet the people of Southern countries themselves are often the least wasteful.

Our increased wealth and prosperity have come at a price. We have built mountains of waste in the North and left scarred environments and societies in the South. These activities aim to provide children and schools with knowledge, understanding and actions on how we can dump our throwaway society and wage war on waste.

There have been substantial increases in recycling rates in the UK in recent years. Almost half of all household waste is now recycled, though percentages vary between different regions of the UK. However, this still leaves a lot of waste that ends up in landfill sites or being burnt in incinerators. Both processes are environmentally damaging. In landfill, waste rots down to produce methane - a powerful 'greenhouse gas' – and poisonous liquids. Burning waste can produce health-harming emissions and only reduces the weight of the waste by approximately two thirds. The toxic ash left behind must be got rid of – usually it is sent to landfill sites.

So, step up recycling?

Recycling reduces pollution, saves energy and reduces costs while slowing down the rate at which non-renewable resources are depleted. Recycling saves resources. One tonne of recycled newsprint is equivalent to almost a dozen trees. Recycling half of the world's paper would meet over 70% of global demand for new paper and save 8 million hectares of forest. Recycling saves energy. It requires 20-25 times more energy to make aluminium by smelting bauxite than it does to melt and produce 'new' aluminium from scrap. Recycling also creates jobs. At least 30,000 people are involved in recycling aluminium in the US; twice the number employed in primary aluminium production.

Yet, despite the obvious benefits, recycling is in fact the lowest priority in the '4 Rs' waste minimisation hierarchy. The most important priority is to **reduce** the amount of waste we create in the first place. Next comes **re-use**, followed by **repair** and finally **recycling**.

The South – already there

Rarely acknowledged is the fact that countries in the South create some of the lowest levels of waste. This is because thousands of poor people earn a living by collecting materials dumped at public waste-disposal sites or in the streets for turning into something useful. Resources also tend to be reused and repaired to a much greater extent. Many poorer countries for example operate a deposit scheme on bottled drinks while Cuba is famous for keeping its ancient fleet of American cars running. Most significantly Southern countries tend to produce much less waste in the first place and use considerably less energy. Mexico produces just half the waste per person per year as the US, and Bangladesh has the lowest consumption of energy per person per year in the world.

Most Southern countries haven't deliberately chosen to be low waste, reuse, and repair economies. They have ended up as such due to poverty and limited resources. But perhaps it is time for the affluent, and consequently wasteful, economies of the North to learn some lessons in waste management from the South.

Waste audit	Numeracy Waste	
A numeracy activity investigating the amount of waste produced in class and the school	45 mins	Year 3 and 4

Suggested lesson structure - Mental and oral work

The lesson could begin with practising and reinforcing previous knowledge on calculating mentally half, quarter, three quarters or one tenth of kg weights. Children could also be challenged with reverse calculations, e.g. what is 500g or 2500g expressed as kg etc.

The main activity

This activity could be carried out at home, in the classroom, or in the school more widely. Whichever is selected – and it could be both home and school for comparison - rubbish will need to be collected over a period of one week and separated into its different materials. A small group of children could perhaps be responsible for ensuring that rubbish is saved and separated into its different parts in school.

This is a good exercise in itself, involving thinking about different forms of rubbish we create and separating it out at the point of discarding it. Children could be asked which types of rubbish they currently recycle at home and which they don't. They could consider the same question for rubbish in the classroom/at school. Developing such skills and habits are vital if we are to reduce waste and increase recycling and carrying out the exercise at home could involve other family members.

After a week of collecting the rubbish, either at home or school, each material will need weighing. In school, different groups could be responsible for a particular material and decide which measuring equipment is the most suitable for the task. (Spring balances, bathroom scales etc)

Once the different materials are weighed, children can complete the table and draw a bar chart before interpreting the data and answering the questions. Some bar charts could be generated on the computer. Question 3 is aimed at more able children as it involves more complex calculations. Less able pupils could complete the bar charts and Question 1. Question 4 is for wider discussion.

Weight is the generally recognised method of measuring waste, but volume or bulk would be another method. Weighing waste fails to account for which types are most damaging to the environment. For example, plastic waste is generally light but often bulky and is non-biodegradable. Conversely food/green waste is generally heavier but will either rot or can be turned into compost.

Measuring classroom waste (pupils question sheet)

The aim of this activity is to find out what sorts of rubbish are created in your home, classroom or school and which materials create the most rubbish.

Begin by weighing the amount of each material thrown away in your home, classroom or school over a week. Complete the table below and work out the total amount of rubbish created in one week.

Material	Weight in grams
Paper	
Cardboard	
Metal	
Glass	
Plastic	
Food and green waste	
Textiles	
Wood	
Other	
Total weight in Kg and grams	

Draw a bar chart to show the different materials thrown away in your home, classroom or school during one week.

Place the different materials along the bottom, horizontal axis and the weight in grams and kgs along the vertical axis.

Use the table above and your bar chart to answer the following questions:

1. Which material created the most and least waste by weight over the week?
2. Which of the materials above could be recycled or reused rather than thrown away?
3. If these materials are reused or recycled, by how much could your home, classroom or school waste have been reduced?
4. Do you think weight is a good way of measuring waste? What other ways could you use to measure the amount of waste created?

Plenary session

The main purpose of the plenary session will be to share the information, interpret the bar charts and examine some of the waste issues raised through this activity. The information could be displayed somewhere prominently in the school for others to see.

A follow up exercise could involve children suggesting ways at home or in school to reduce waste. A home, class and/or School **Waste Reduction Action Plan** could be devised (see below). The ideas could be tried and the amount of rubbish measured again a few months later to see if the amount of rubbish has decreased.

Sustainable sustenance activity

This activity aims to examine the extent and nature of rubbish created through packed lunches. Children investigate what happens to their packed lunch rubbish and consider how this could be reduced. The activity would be particularly useful after an event or outing in which all children in the class/group have packed lunches.

Suggested format of activity

Each child counts the number of pieces of rubbish from their packed lunch and writes down what they are.

Children should then pool their waste/leftovers to demonstrate the total waste and the total number of pieces of rubbish can be calculated.

Children should next discuss what happens to waste from this point on, i.e. enabling children to think 'beyond the bin' to understand that rubbish is buried or burnt.

At this point 3Rs can be introduced and discussed - **Reduce, Reuse, Recycle** - in relation to the different categories /materials of rubbish from the packed lunches. For example: cans (recycling), plastics (some areas now offer plastic recycling schemes, other items such as bottles, tubs etc. could be reused), organic waste (some may be compostable), paper/cardboard (recycling)

Finally, consider the most important 'R': **Reduce**. Discuss this in relation to packed lunches, e.g. using reusable lunch boxes for sandwiches rather than foil or plastic bags, decanting from large bottles to refillable plastic bottles for drink rather than buying small individual cartons or cans etc.

Ask children to consider again their packed lunches and the amount of rubbish they created and think in pairs/groups how they could change their packed lunches to reduce the amount of rubbish. They could then design a poster to promote their ideas around the school.

Based on an activity idea provided by the Lancashire Global Education Centre

School Waste Reduction Action Plan

Here are some ideas that might be included in an Action Plan to reduce waste in school:

- Set up a recycling scheme for paper in the school
- Ensure both sides of all paper is used before paper is recycled
- Use scrap paper for rough work and casual notes
- Reuse envelopes
- Have separate bins in the playground and in classrooms for different types of rubbish
- Decant or make up drinks from large bottles and put them into smaller reusable bottles rather than buying individual cartons/cans/bottles
- Avoid heavily packaged food for packed lunches; use a lunch box which can be reused again and again rather than tin foil or plastic
- Reuse plastic pots, trays and other packaging for storage of classroom equipment, in artwork or for growing plants in
- Make sure that a collection/recycling method exists in school for the collection of glass, plastic bottles, aluminium cans and batteries or encourage children to take these items home with them for recycling
- Ensure that reusing and recycling of old/outgrown clothes and school uniforms, is encouraged, e.g. second hand collections available to children, collection of old clothes for charity shops
- Encourage children to save old toys for charity or for school fetes or toy sale days, which also generate income for the school etc.
- Start a school compost heap/bin for green waste

	Knowledge and Understanding		Skills		Values and Attitudes
<input type="checkbox"/>	Social justice and equity	<input checked="" type="checkbox"/>	Critical thinking	<input type="checkbox"/>	Sense of identity and self-esteem
<input type="checkbox"/>	Diversity	<input type="checkbox"/>	Ability to argue effectively	<input type="checkbox"/>	Empathy and sense of common humanity
<input type="checkbox"/>	Globalisation and Interdependence	<input type="checkbox"/>	Ability to challenge injustice & inequalities	<input type="checkbox"/>	Commitment to social justice and equity
<input checked="" type="checkbox"/>	Sustainable development	<input checked="" type="checkbox"/>	Respect for people and things	<input type="checkbox"/>	Valuing and respecting diversity
<input type="checkbox"/>	Peace and conflict	<input type="checkbox"/>	Co-operation and conflict resolution	<input checked="" type="checkbox"/>	Concern for the environment and commitment to sustainable development
				<input checked="" type="checkbox"/>	Belief that people can make a difference

it's been rubbish for years!	Numeracy Waste	
A numeracy activity examining the recent history of waste and how we can reduce it	45 mins	Year 5 and 6

Suggested lesson structure

This activity could be used as an introduction to an understanding of percentages as the number of units out of every 100.

Mental and oral starter

This part of the lesson should reinforce and practise the concept of percentage as the number of parts in every 100. Mental work could involve finding simple percentages of various small whole-number quantities. Children could be presented with money puzzles, e.g. if I had 20% of £1.00 in my pocket what coins might I have in my pocket? What about 50% of £1.00? 99% of £1.00? etc. This idea could then be extended to ask children to calculate 20% of £2.00/£4.00 etc.

The main activity

The activity provides an opportunity to combine understanding of percentages with accurately reading and interpreting real life data presented in the form of a graph.

Introduction: A few simple calculations and strategies should be discussed, e.g. 20% of multiples of 100 such as 20% of 300, 400, 1000 etc. The worksheet below may be used and discussed with the whole class.

Tasks: Less able children could work on the activity with support and focus on the first three questions. More able children could be challenged to work out kg quantities of different rubbish materials for the average 1990s person throwing away 400kg per year.

Plenary session

The main purpose of the plenary session will be to explore the calculation strategies used in the numeracy questions. It is also important that there is an opportunity, either during the plenary session or at another time, to examine some of the waste issues raised in the questions for discussion, particularly that there have been positive and negative changes since the 1930s and that waste can be reduced. Below is some information which may be useful for this discussion.

In the 1930s

- Plastic was virtually unknown as a packaging material.
- Most households had a coal fire which generated significant amounts of ash and dust, hence the high percentage of this type of waste and the name dustbin
- People burned much of their paper waste
- Liquids were packaged in glass containers which could be returned for a refund and then refilled

In the 1960s:

- Fewer homes had coal fires because of the Clean Air Act 1956, introduced after severe smog's in the late 1940s and early 1950s.
- More and more homes introduced central heating systems
- Glass deposit schemes began to disappear and plastics began to appear in household waste.

In the 1990s:

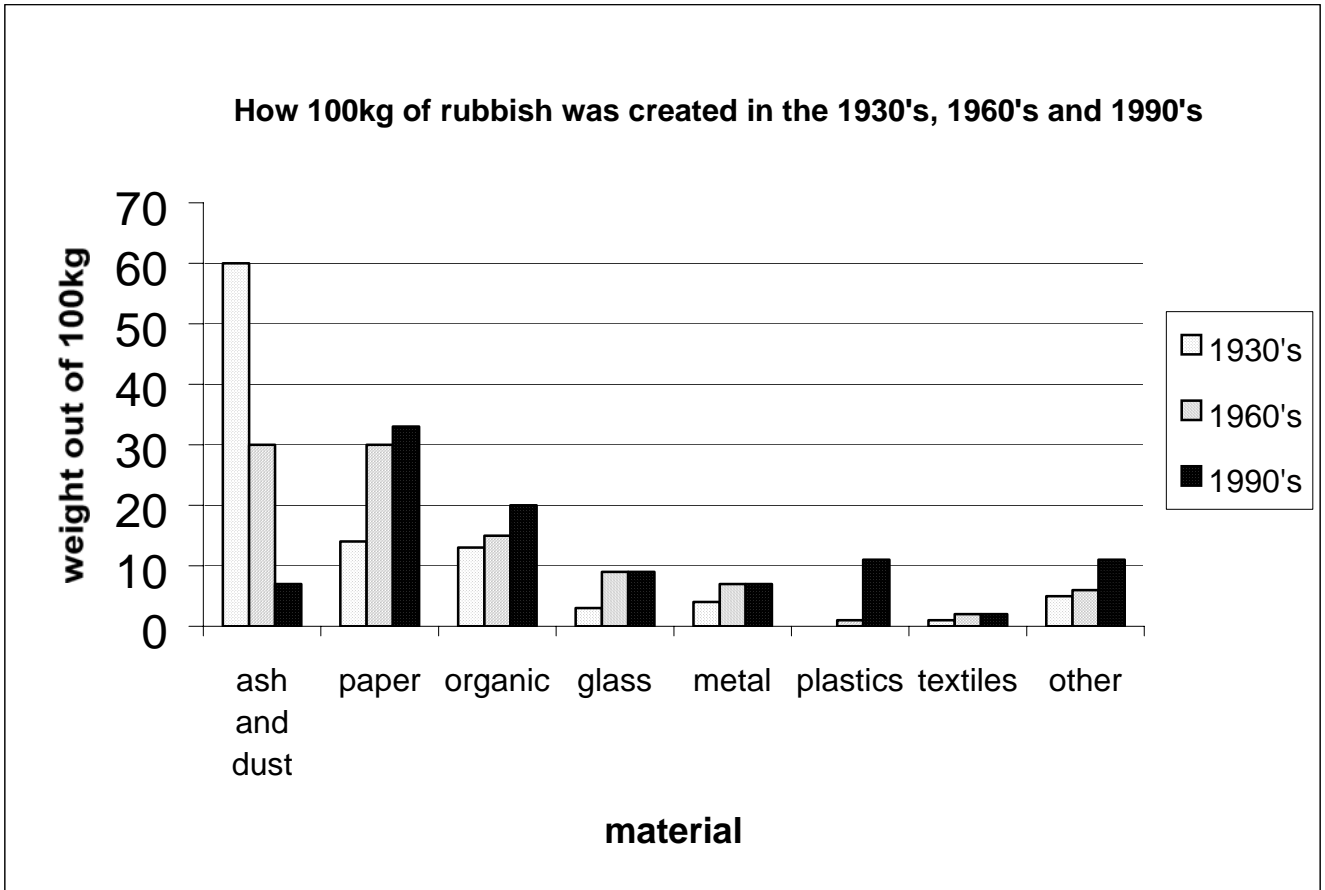
- Hardly any homes used a coal fire as their main source of heating.
- The range of plastic packaging had increased substantially
- As people became better off financially the amount of waste in weight and volume rose by about 2% per year.
- Most paper, the highest percentage of waste by weight in the 1990s, could have been recycled but the majority was not.

'Other' rubbish could include furniture, wood, batteries, appliances and cardboard.

...And the situation today:

- Household waste appears to have 'peaked' and is currently around one million tonnes less than in 2004/2005
- Recycling has increased to around 40% nationally from just 12% ten years ago

The rubbish split



The graph above shows how much rubbish was created by each of seven different materials in the 1930s, 1960s and 1990s out of every 100kg of rubbish. Percentage (%) is a word that means 'out of every 100'.

Answer the following questions using percentages.

1. Estimate the percentage of each type of rubbish in the 1960s. Check the total adds up to 100%
2. Which two materials have not changed their percentage between the 1960s and 1990s?
3. Estimate the difference in percentage of paper waste between the 1990s and the 1930s
4. Each person in the UK created about 400kg of waste per year in the 1990s. 20% of rubbish in the 1990s was organic, (things like fruit and vegetable peelings and thrown away food). This means 20kg out of every 100kg was organic rubbish. Estimate what weight of organic rubbish each person created in the 1990s.

Questions for discussion

1. Which material formed the most rubbish in the 1930s? Why do you think this was? Why had this type of rubbish reduced so much by the 1990s?
2. Which material formed the most waste in the 1990s? What could we do to reduce this type of rubbish?
3. Why was there no plastic rubbish in the 1930s? Why has plastic waste increased so much by the 1990s? How could we reduce the amount of plastic waste we create?
4. What types of rubbish might be in the 'other' category?

What a Waste! Challenge

An average person in the UK throws away approximately 450kg of rubbish each year.

Try the challenge below to see if you can estimate accurately the equivalent number of individual items the weight of material represents.

How could you check or test your estimates?

1. Estimate...

Material	Weight (KG)	Equivalent to
Paper and cardboard	149	_____ magazines
Organic – things that rot	90	_____ banana skins
Plastics	50	_____ drinks bottles
Glass	41	_____ jam jars
Metals	30	_____ baked bean cans
Textiles	9	_____ T-shirts
Other	81	_____ batteries
Total	450	

Calculate...

- We each use about 6 trees worth of paper a year (unless of course we use scrap and buy recycled paper!). How many trees a year does this mean are used by your class?
- The amount of textiles thrown away each month weighs the same as 40,000 cars. How many cars worth of textiles are thrown away each year?
- It has been worked out that for every £50 spent on buying things, £8 goes to pay for the packaging! How much would a family that has spent £3000 on things have paid for the packaging?
- If milk is bought in glass bottles the bottles can be returned to be refilled time and time again. If a family who buy two cartons of milk a day switch to buying refillable bottles instead how many cartons would they prevent being thrown away over a period of four weeks?

Answers

Estimate...

149 kg of paper and cardboard equivalent to 570 magazines

90 kg organic equivalent to 2000 banana skins

50 kg of plastic equivalent to 900 drinks bottles

41 kg of glass equivalent to 164 jam jars

30 kg of metal equivalent to 630 baked beans cans

9kg of textiles equivalent to 45 T-shirts

81 kg of other waste equivalent to 1800 batteries (9 volts)

Calculate...

1. 6 x number of children in the class. A significant bit of forest!

2. $40,000 \times 12 = 480,000$ cars worth of textiles thrown away every year!

3. $(£3000 \div £50) \times 8 = £480$ spent on packaging!

4. $(2 \times 7\text{days}) \times 4 = 56$ cartons saved from the bin!

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