

Scientific Enquiry Materials

KS2

SOMETHING TO CHEW ON



First published in 2007

© The Centre for Research in Primary Science and Technology (CRIPSAT), University of Liverpool

ISBN 978-0-9557200-1-7

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Further copies may be ordered from CRIPSAT, 126 Mt Pleasant, University of Liverpool, L69 3GR
Tel: 0151 794 3270

Printed by Zenith Media, Cardiff, CF15 7QR

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Levels 2–5**Resources**

- ▶ Enquiry Sheet – What's in chewing gum?
- ▶ a wide variety of chewing gum wrappers
- ▶ Internet access

**Links to skills in the Science PoS**

This activity offers pupils the challenge of searching for and processing information. Emphasis is on planning, as they are required to recognise and decide where and how to find the relevant information. They identify the information required and reflect on it through discussion, recording their findings in writing.

What's in chewing gum?**Overview**

This activity invites pupils to research and identify the materials used to make chewing gum. They are required to find out why these materials are added and where the materials come from.

Activity

As a starting point for this activity, ask pupils whether or not it might be possible to make their own chewing gum. Ask them what materials they would use. Explain that they are to find out all the materials that are used to make chewing gum. They might use chewing gum wrappers and the Internet as sources of information. They should find out and discuss what materials are used to make chewing gum, why these materials are added and where these materials come from. The Enquiry Sheet could be used by pairs of pupils to record some of the results of their search.

Suggested questions

What materials are found in gum?

What sources of information could you use to find out about the ingredients in chewing gum?

Are all types of chewing gum made from the same ingredients?

Are the materials grown, found in the ground or made in a laboratory or factory?

Supplementary activities

Pupils could use their research skills to find out:

- ▶ how chewing gum is different to bubble gum
- ▶ how sugar-free gum is different to other chewing gum

Pupils could make an advert, e.g. a video clip or a poster to show how sugar free gum is better for teeth than other types of gum.

Pupils could collect evidence to support or challenge a claim that 'sugar free is better for teeth than other gum'.

[illegible]

Levels 2–5**Resources**

- ▶ Enquiry Sheet – Investigating chewing gum
- ▶ samples of chewing gum



children should use
unchewed gum

Links to skills in the Science PoS

This activity allows pupils the opportunity to turn suggested ideas into a form that can be investigated. Through careful observation they describe changes and reflect on their methods through class discussion. Pupils record their results in writing.

Investigating chewing gum**Overview**

This activity requires pupils to investigate some questions about the properties of chewing gum and to record their observations as results.

Activity

Review with pupils the idea that every material has a range of different properties. For example, paper burns and rots. The Enquiry Sheet lists some questions that can be asked to find out about the properties of different materials.

Pupils working in groups could plan and carry out an investigation that might answer each question. They could describe any change to the chewing gum in the results column in the table. Encourage pupils to report their methods and observations to the class.

Encourage pupils to think about what their results suggest about how difficult chewing gum might be to remove from clothes.

Suggested questions

What investigations will you carry out to find the answers to the questions?

Have you planned to investigate the gum at different temperatures?

Have you planned to investigate different types of gum?

What changes did you notice?

What do your results tell you about the properties of gum?

Do you think gum would be easy or difficult to remove from clothes?

Supplementary activities

Pupils could use the results from the whole class to make a list of the properties of chewing gum.

Pupils could compare the properties of chewed and non-chewed gum.

Every material has different properties, e.g. paper burns and rots.
Look at the list of questions below.

- ▶ Decide how you will investigate chewing gum to answer each question.
- ▶ Carry out your investigation with a sample of chewing gum.
- ▶ Describe any change to the gum that you observe as your results.

question	our investigation to answer the question	our results
Does chewing gum melt?		
Does chewing gum freeze?		
Does chewing gum dissolve?		
How sticky is chewing gum?		
Does chewing gum stretch?		

Share your investigations and results with your class.

What do your results suggest about how easy or difficult chewing gum is to remove from clothes?

Levels 3–5**Resources**

- ▶ Enquiry Sheet – Chewing gum flavour



children should wear gloves if investigating chewed gum

Links to skills in the Science PoS

The emphasis within this activity is on pupils planning and carrying out a fair test and reflecting upon their approach and findings.

Chewing gum flavour**Overview**

This activity requires pupils to plan and carry out an investigation to find out how long the flavours of different kinds of chewing gum last.

Activity

Firstly, introduce the idea that the ingredients in chewing gum allow the flavour of the gum to last for a long period of time. A discussion of different questions could help signal that an investigable question has both a variable to be changed during the investigation (the independent variable – IV) and a variable to be measured as a result (the dependent variable – DV). The pupils should plan an investigation that finds out how long the flavours of different chewing gums last, using the Enquiry Sheet to record their plan. In this investigation the DV will be the time taken until no flavour is left in the chewing gum.

Ask pairs of pupils to review their own plan to check that the IV, DV and control variables are consistent with the question they are investigating.

When the pupils have reviewed their plans, ask them to carry out their investigation.

They should record results appropriately and think about the best way to present these results and what conclusion can be drawn from them.

Suggested questions

What variable are you going to change as you carry out your investigation?

What variable are you going to measure to collect your results?

Why is only one variable changed in an investigation?

What variable will you need to keep the same as you carry out this investigation?

Why are some variables controlled in an investigation?

What is the best way to record the results of this investigation?

What conclusion can you draw from your results?

What could you do to improve your investigation?

Supplementary activities

Pupils could think of other questions they could investigate about chewing gum and identify the variables suggested by each question.

Claim

Some chewing gum makers claim that, 'The flavour of our gum lasts for a longer time than other gums.'

Plan an investigation of this claim.

Think about:

- ▶ the question you plan to investigate;
- ▶ the variable you will change as you carry out your investigation (independent variable);
- ▶ the variable you will measure as you collect your results (dependent variable);
- ▶ any variable to be kept the same to help make the test fair.

the question I will investigate:	
the independent variable to be changed during the investigation:	
the dependent variable to be measured as a result:	
the variables to be kept the same to help make the test fair:	

Working with a partner, check that the variables you plan to change and measure are a good fit with your question.

Carry out the investigation you have planned.

Think about:

- ▶ the best way to record your results;
- ▶ the best way to present your results;
- ▶ any conclusions you can draw from your results;
- ▶ any problems you found in making accurate measurements;
- ▶ how an advert or a slogan might sum up your results.

Levels 2–5

Resources

- ▶ Enquiry Sheet – Chewing gum survey
- ▶ keepwalestidy.org



Links to skills in the Science PoS

This activity requires pupils to plan and develop questions to include in a survey. It emphasises reflection on the merits of particular questions. Having carried out the survey pupils reflect on their results and agree a digital presentation of their findings.

Chewing gum survey

Overview

This activity invites pupils to devise a simple survey to find out more about chewing gum use. The class could plan a shared investigation or pupils could plan their own investigations. They are required to collect and record their findings and draw conclusions about chewing gum use.

Activity

Tell pupils they are to carry out a simple survey in school to find out more about pupils' use of chewing gum. They might find out, for example: who buys gum, why people chew it, what they do with it when they have finished with it and whether they have ever got chewing gum stuck on clothes or shoes.

Working in pairs, ask the pupils to think of some questions that they could use in their survey of pupils' use of chewing gum. Ask them to try to justify the inclusion of their questions in the survey. They could record their questions on the Enquiry Sheet. You might wish to organise a class discussion to agree the questions to be included in the survey. When the class has agreed the set of questions to be asked, they should carry out the survey and collect their results.

Once the results are collected, pupils can put them into spreadsheets or make tables and graphs to present the findings. They could look at whether there are any age or gender differences in chewing gum users. Encourage them to interpret their findings.

Pupils should decide how they will share results of their survey. They could use video or audio clips, posters or PowerPoint to present their findings to other classes.

Suggested questions

What questions will you ask to find out who buys gum?

What questions will you ask to find out how often people use chewing gum?

What questions will you ask to find out how people get rid of gum?

Supplementary activities

Pupils could survey family and friends' use of chewing gum.

Pupils could find out whether people chew other things, e.g. pencils.

Pupils could investigate whether chewing gum helps people to concentrate better.

Your class will carry out a survey of chewing gum use by pupils in your school.
Think of some questions that you would like to include in the survey.
Justify why your questions should be included in the survey.

1.	
	
2.	
	
3.	
	
4.	
	
5.	
	

When the class has agreed the set of questions that will be asked, you will carry out the survey and collect your results.

Think about what your results tell you about the use of chewing gum in your school.

In groups, decide how you will present your results.

You could present your results using a CD, DVD or a PowerPoint through the interactive whiteboard.

Levels 2–5

Resources

- ▶ Enquiry Sheet – Chewing gum nuisance
- ▶ keepwalestidy.org
- ▶ encams.org



pupils should be accompanied by an adult during their investigations

Links to skills in the Science PoS

This activity requires pupils to make predictions using previous knowledge. They interpret and justify their ideas, communicating them in a range of ways.

Chewing gum nuisance

Overview

This activity invites pupils to think about some of the reasons for gum litter.

Activity

Chewing gum on pavements is judged to be the fourth worst nuisance by people in Wales. 935 million packets of gum are sold in the U.K. per year. Tell pupils that in some places there is an average of 20 blobs of gum for every square metre of pavement. Denbighshire spends up to £30,000 a year on removing gum litter. The cost of removing gum from pavements in the UK is £150,000,000 per year. Ask the pupils to think about where a lot of chewing gum might be dropped and places where very little might be dropped in their local environment. Encourage them to justify their ideas with reasons.

Pupils could record their ideas and reasons on the Enquiry Sheet.

Suggested questions

- Why is dropping gum a problem?
- Where do you think you see the most blobs of chewing gum?
- Why do you think most gum is found in those places?
- What time of day do you think most gum is dropped?
- Where are you unlikely to find gum on the floor or pavement?
- Who do you think drops most gum?
- Why do you think people drop gum?

Supplementary activities

Pupils could be encouraged to observe the number of chewing gum blobs in some nearby places at weekends or evenings. They could carry out an investigation using a quadrat to compare the number of blobs of chewing gum in different places.

Pupils might try to think of the other three issues that were identified as a nuisance by people in Wales. Encourage them to rank order their ideas and discuss their reasons.

The cost of removing gum from pavements in the UK is £150,000,000 per year.

In some places there is an average of 20 pieces of gum for every square metre of pavement.

In pairs, list the places where you might see a lot of chewing gum that has been dropped. Explain your ideas.

places where a lot of chewing gum is dropped	reasons why chewing gum is more likely to be dropped in these places

In pairs, list the places where you might see very little chewing gum that has been dropped. Explain your ideas.

places where very little chewing gum is dropped	reasons why chewing gum is less likely to be dropped in these places

Levels 3–5

Resources

- ▶ Enquiry Sheet – Measuring chewing gum blobs
- ▶ chewing gum
- ▶ Internet access
- ▶ rolling pin
- ▶ keepwalestidy.org
- ▶ encams.org



pupils should use gloves and wash their hands

Links to skills in the Science PoS

Pupils decide the measurements to be made. They describe their methods in writing and reflect on them by sharing their ideas with the class.

Measuring chewing gum blobs

Overview

This activity encourages pupils to measure and compare the area of chewing gum before it is chewed and after it is chewed and rolled out. Pupils discuss and describe in writing their methods for calculating the area of gum.

Activity

Discuss with pupils how when anyone steps on a blob of discarded chewing gum, the area of ground it covers gets bigger.

Give pupils a 'tablet' of sugar-coated gum and ask them to draw a line around it in Box 1 on the Enquiry Sheet.

Ask pupils to chew the gum until it has no more flavour and then to drop the gum out of their mouths onto a sheet of plain paper. They should then use a rolling pin or a similar implement to roll out the biggest blob they can make out of the discarded gum. Ask the pupils to place Box 2 on the Enquiry sheet over the rolled out gum and to draw around the outline of the gum.

Encourage pupils to compare their outline drawings and to quantify their comparisons by measuring the areas of their drawings. They could describe how they calculated the areas on the Enquiry Sheet.

Suggested questions

How big do you think your blob of chewing gum will be?

Could you make it even bigger?

How does your blob of rolled chewing gum compare with the area of the tablet before it was chewed?

How would you compare the size of your blob of chewing gum with others in the class? Would you measure the length around the outside or the area?

What units of measurement will you use?

Supplementary activities

Pupils could repeat the activity using different sized pieces of gum and begin to look for patterns in their measurements.

Pupils might investigate how the number of rolls of a rolling pin affects the size of the blobs of chewing gum.

Pupils could try to find out what area 1cm^3 of gold could cover as 'gold leaf'. (1cm^3 is roughly the volume of one tablet of chewing gum.)

Box 1

Box 2

Description of how the area of the chewing gum is calculated:

Levels 3–5

Resources

- ▶ Enquiry Sheet – Ideas about the gum nuisance
- ▶ Internet access
- ▶ keepwalestidy.org
- ▶ encams.org



Links to skills in the Science PoS

Pupils consider the points of view of three different stakeholders having a different interest. The emphasis is to introduce pupils to the skill of evaluating ideas by first thinking of the advantages and disadvantages of each idea and progressing to the collection and use of evidence to support or challenge ideas. The activity allows pupils to communicate their ideas in speech and writing.

Ideas about the gum nuisance

Overview

This activity invites pupils to think about and discuss three different approaches to reducing the nuisance of chewing gum in the environment. They consider the advantages and disadvantages of each approach before saying which approach they favour and why.

Activity

Explain to pupils that a 'Keep Wales tidy' survey in 2003 showed that gum on pavements was the fourth worst local environmental issue of concern to people living in Wales. Give pupils the Enquiry Sheet that describes three different approaches to solving the problem of gum in the environment.

They should read each idea and then, in pairs, think of the advantages and disadvantages of each idea.

Pupils may think of other approaches that can be added to the discussion. They should then decide which approach they favour using the list of advantages and disadvantages and give a reason why.

Suggested questions

What are the points in favour of this approach?

What do you think might be the problem with this approach?

Looking at all the advantages and disadvantages, which approach do you favour?

Supplementary activities

Pupils could discuss the reasons why different people might hold their particular viewpoint.

Pupils could collect evidence of the efficacy of different approaches and present arguments in favour of a particular approach. Remind pupils to be prepared for counter arguments that challenge their approach.

Pupils could design enquiries that would measure the effect of each approach.

Chewed gum is really difficult and expensive to remove from the pavement. Three different people suggest three different ways of solving the problem. Look at these ideas from different people. In pairs, discuss the advantages and disadvantages of each idea.

Shopkeeper



We need to persuade people to stop dropping gum.

Chewing gum maker



We need to make gum that does not stick to the pavement.

Council officer



We should spend more money on removing gum from the pavement.

idea	advantages	disadvantages
We should spend more money on removing gum from the pavement.		
We need to make gum that does not stick to the pavement.		
We need to persuade people to stop dropping gum.		
Say which idea you favour and why.		

Levels 4–6**Resources**

- ▶ Enquiry Sheet – Solving the gum problem
- ▶ Internet access
- ▶ keepwalestidy.org

**Links to skills in the Science PoS**

Pupils are encouraged to form considered opinions by weighing up advantages and disadvantages of different proposals for the reduction of gum litter. They reflect on their decisions and justify their reasoning.

Solving the gum problem**Overview**

This activity requires pupils to read information about the nuisance of gum litter from the 'Keep Wales Tidy' organisation. They are required to interpret and use the information by deciding on the action they would take to tackle the nuisance of gum litter in their own area.

Activity

Ask pupils to read the report on the Enquiry Sheet 'Solving the gum problem'. Tell them it is a summary of a real investigation into the nuisance of gum litter reported by the 'National campaign to reduce gum litter' and the 'Keep Wales tidy group'. The investigators have compared different ways of persuading people to stop dropping gum on the pavement.

Pupils are asked to imagine they are to advise local councillors dealing with the expensive problem of gum litter. They are to use the information in the report and any other evidence they can find to help them decide on actions they would recommend the council to take to reduce gum litter.

Pupils should prepare reasons to justify their decision to recommend this action to the local council.

Suggested questions

What do you learn from the report?

What would you advise your local council to do about gum litter?

What are the advantages and disadvantages of your suggestions?

What reasons can you give to justify your suggestions?

Supplementary activities

Pupils might explain an issue of local or national interest by collecting evidence to support or challenge different points of view.

Imagine you are writing a report to advise your local council on how to deal with the nuisance of chewing gum litter. You can read some ideas from the 'National campaign to reduce gum litter' and the 'Keep Wales tidy' campaign, presented below.

The advertising slogan – ‘...thanks for binning your gum when you’re done’ – was remembered by over 55 per cent of those questioned in the post-campaign surveys, while the gum pouches [small bags], which provide a clean disposal option when there are no bins around, were also well-received.

In one town, ‘Gum Boards’ – boards people could stick their used gum on to – collected 1,000 gum blobs every week.

In another town, the campaign to reduce gum resulted in an 80% reduction.

However, it was the threat of the fines that was most effective at stopping people dropping gum.

Downloaded from keepwalestidy.org – 19 April 2006

- ▶ discuss what evidence you would need in order to know how effective each idea would be;
- ▶ think about the advantages and disadvantages of each action;
- ▶ using this information and your own ideas, discuss in pairs what actions you would advise your local council to take to reduce gum litter on the pavements;
- ▶ when you have decided on your actions, give reasons to justify each action you wish to recommend.

Make sure you include any differences of opinion in your report.

Levels 4–5**Resources**

- ▶ Enquiry Sheet – Claims about chewing gum
- ▶ wide variety of chewing gum wrappers
- ▶ Internet access

**Links to skills in the Science PoS**

The activity invites pupils to replicate an investigation. The emphasis is on developing and reflecting rather than planning. The design of the investigation models the inclusion of a control group. Pupils are required to reflect on their evidence in relation to a scientist's claim.

Claims about chewing gum**Overview**

This activity invites pupils to carry out an investigation into a claim that chewing gum improves memory using three groups: gum chewers; non chewers; pretend chewers.

Activity

Ask pupils to think of any claims they have heard about the benefits of chewing gum.

Encourage them to share these claims to make a class list.

Ask them to read the claim made by scientists on the Enquiry Sheet that 'Remembering lists of words is helped by chewing gum'. Ask the pupils to plan and carry out an investigation of this claim. Pupils are encouraged to use three groups like the original study and to decide what task each group will be given and what they will be asked to try and remember.

If carried out as a class activity, a record of results for the class could be constructed.

Encourage pupils to evaluate their results and think whether or not their findings support the scientists' claim. They could decide as a group how they would present their results to other scientists.

Suggested questions

How will you decide on your three groups?

What will you ask each group to do?

What will you ask the pupils to try and remember?

What will you measure to collect your results?

Do your results support the scientists' claim?

What is the best way to present your results to the rest of the class?

Supplementary activities

Pupils could discuss the reasoning behind using the three groups in this investigation.

Pupils could investigate other claims on the 'health advantages' or 'benefits' of chewing gum, e.g. helps concentration, cleans teeth.

Scientists claim:
'Remembering lists of words is helped by chewing gum'.

In tests, scientists found that people's ability to remember lists of words improved among people who chewed gum.

Scientists at a University checked this claim. They used three groups of people carrying out tasks.

Group 1: chewed gum

Group 2: didn't chew gum

Group 3: pretended to chew gum

Carry out an investigation of the claim that, 'Remembering lists of words is helped by chewing gum'.

Using three groups, decide what task you will give each group and what you will ask them to try and remember.

Carry out your investigation and record your results in the table.

group	results
1 – chewed gum	
2 – didn't chew gum	
3 – pretended to chew gum	

Do your results support the scientists' claim? Think of reasons for your results. Decide as a group how you would present your results to other scientists.

Levels 3–5**Resources**

- ▶ Enquiry Sheet – To chew or not to chew?
- ▶ a wide variety of chewing gum wrappers
- ▶ Internet access
- ▶ keepwalestidy.org
- ▶ encams.org

**Links to skills in the Science PoS**

This activity requires pupils to search for, access and select relevant evidence using secondary sources. They use the evidence to support their claim and communicate their ideas in writing and speech.

To chew or not to chew?**Overview**

This activity requires pupils to argue for or against the chewing of gum. They are asked to collect evidence from secondary sources, to form an argument based on their evidence and to present their ideas in a class discussion.

Activity

As a starting point for this activity, ask pupils to think about the arguments they have heard for and against the chewing of gum.

In groups, pupils should use secondary sources to collect evidence for and against the chewing of gum. They should decide which evidence is stronger and construct an argument for or against the chewing of gum based on their evidence. They could describe their ideas on the Enquiry Sheet.

Pupils could agree the most relevant evidence in support of their view before presenting their arguments and evidence in a class discussion. Tell them to be prepared for arguments that are different to their view – rebuttals.

Suggested questions

What evidence can you find to support your arguments?

What is the strongest evidence you can find for your argument?

What evidence might you expect that could challenge your argument?

What arguments could challenge your view?

How will you deal with an argument that challenges your view – a rebuttal?

Supplementary activities

Pupils could record the arguments as a Podcast to share with others.

Pupils could review the Podcast as a group or class to check and improve their use of evidence to support an argument. Pupils might be asked to vote to judge whether the arguments for or against are most persuasive.

Collect evidence **for** and **against** the chewing of gum using the Internet and other secondary sources.

Decide which evidence is stronger and use it to argue **for** or **against** the chewing of gum. Describe your ideas below.

Present your arguments and evidence in a class discussion. Be prepared for arguments that are different to your view – what are known as ‘rebuttals’.

argument	evidence

Produced by
The Centre for Research in Primary
Science & Technology (CRIPSAT),
The University of Liverpool

Sponsored by the Welsh Assembly
Government

Authors:
Terry Russell
Linda McGuigan
Dewi Roberts
Mark Thomas