

# Crisps

Teachers' Guide



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Before beginning this activity it may be wise to give some consideration to the composition of the groups. Much of the work and ideas for the investigation should come from the pupils themselves so a good mix of abilities within a group may be an advantage. It may also be a good idea to assign some group roles. The description of these roles could be displayed on the wall during the investigation. Some sample roles are included in the appendix.

Pupils sheets are available. This is not a comprehensive list of instructions but a general information booklet to help guide the pupils through the investigation.

## Risk assessments

Under the COSHH Regulations, the Management of Health and Safety at Work Regulations, and other regulations, employers are responsible for making a risk assessment before hazardous procedures are undertaken or hazardous chemicals used or made. Teachers are required to co-operate with their employers by complying with such risk assessments.

For further information contact SSERC in Scotland and CLEAPSS in the rest of the UK.

A suggested structure of activities is proposed below. This is by no means prescriptive and should be altered to suit the needs of individual classes, pupils and teachers.

## Brief outline of possible lessons

Activity	Title	Brief outline	Skills / Concepts	Outcome
1	Introduction (45 mins)	Class discussion about fats in foods Research activity	Researching, exploring, investigating	LIT 3-02a LIT 3-05a LIT 3-14a HWB 3-15a
2	Exploring Solubility (20 mins)	Experiment to look for suitable solvents for dissolving fat	Observations	SCN 3-16a – Properties (distillation and dissolution) SCN 3-16b – Properties (solubility using different solvents)
3	Planning the investigation (25 mins)	Demonstration of method of fat extraction Groups plan their own investigation	Solubility in different solvents, distillation, partition co-efficient, condensation, evaporation, fair testing, and reliability	SCN 3-16a – Properties (distillation and dissolution) SCN 3-16b – Properties (solubility using different solvents) SCM 3-20b (topical science) LIT 3-02a LIT 3-05a HWB 3-19a
4, 5+	Carrying out the investigation (45 mins)	Groups carry out their own investigations	Fair testing, reliability, solubility, distillation. Group working skills. Measurements and calculating % fat in crisps	SCN 3-16a – Properties (distillation and dissolution) SCN 3-16b – Properties (solubility using different solvents) SCM 3-20b (topical science) LIT 3-02a LIT 3-05a MNU 3-01a MNU 3-07a MNU 3-20a HWB 3-19a
6	Preparation (45 mins)	Preparing presentation of findings	Evaluating, elaborating	SCM 3-20b (topical science) LIT 3-02a LIT 3-05a LIT 3-06a LIT 3-09a LIT 3-14a LIT 3-21a LIT 3-24a LIT 3-28a
7	Presentations (45 mins)	Oral or poster presentations		LIT 3-09a

## Activity 1: Setting the scene

- ▶ Hold class discussion to introduce the idea of fat in food stuffs and in particular crisps.
- ▶ Give an overview of the investigation (see pupil sheets).
- ▶ Issue 'lab books' in which everything should be noted including web sites
- ▶ Carry out research – probably in a computer lab to find out about different types of fats in food, RDAs, good fats versus bad fats, types of fat in crisps etc. (For example a small calculation shows that some crisps contain as much as 55.4g fat in a packet – that is 80% of an adults RDA.) 'Contemporary chemistry for schools and colleges' by Vanessa Kind RSC 2004 ([www.rsc.org/Education/Teachers/Resources/Contemporary.asp](http://www.rsc.org/Education/Teachers/Resources/Contemporary.asp)) provides useful resources to help pupils to explore different types of fat.

## Activity 2: Exploring solubility

- ▶ Pupils explore solubility of fats and oils in different solvents (water, petroleum ether, acetone etc) – see 'exploring solubility' in pupil sheets.
- ▶ Hold discussion to determine – 'how do you know it is soluble?'

## Activity 3: Planning the investigation

Demonstration of how the fat is to be extracted.

There are a few key principles that can be introduced here:

- ▶ **Solubility** of the fat in the chosen solvent
- ▶ **Partition coefficient** (this term need not be used) – ideally the extraction should be carried out a few times with a small volume of solvent. Reproducible results should be obtainable with one extraction provided the same quantity of solvent is used each time. Again the idea of fair testing comes into play here.
- ▶ **Distillation**
- ▶ **Condensation/Evaporation**

Class discussion regarding fair testing, controlling variables etc.

In groups plan the investigation covering such points as:

- ▶ What is going to be investigated (the list is virtually limitless and may include, cheap vs. expensive crisps, different flavours, low fat vs. normal, sunflower vs. saturated, bakes vs. fried, different brands, different types (quavers vs. hula hoops?). It may even be that a group decides to investigate 'how many extractions are needed to remove the most fat')
- ▶ Which variables need to be controlled?
- ▶ Which measurements are needed?
- ▶ What will be recorded?
- ▶ What are you aiming to calculate?

All ideas should be recorded in their lab books.

Groups should be given the freedom to design their own investigation (see pupil sheets). It is likely that the need to measure the volume of solvent, mass of crisps etc may not occur to pupils during their first run through. It will probably be during the second run through that someone asks 'how many crisps did we use last time? They will then work it out for themselves.

## Activity 4+5 (and possibly 6) Carrying out the investigation

The first practical lesson will be a slow process and not many sensible results will be gained from it although it will depend on how much teacher input you wish to give. Should time be short then most of the practical could be done in one lesson.

## Activity :6

### Preparing the presentation

This may also be done as a home exercise and so before finishing the practical lesson, the group should decide how to present their findings and who in the group is to prepare what for the presentation. An emphasis must be on every person contributing.

The format of the presentation should be left to the groups to decide. It could be a power point presentation, a lesson or a poster.

## Activity :7 The presentation

A point system is available should you wish to encourage a competitive element to the whole task. This should allow presentations to be marked in a consistent manner and may allow a 'winning team' to be identified. It may also be appropriate to use a form of peer assessment here. All pupils could be asked to write down two good things about every presentation and one thing that could have been carried out better (this will work for oral presentations and posters). Questions from the audience should be encouraged.

## Brief outline of possible lessons

There are many ways this investigation could be expanded. Three suggestions are listed below.

### Extension 1: Analysis of the salt content of crisps

An investigation could be designed to 'wash' the salt from crisps and collect the washings. The washings (or concentrated washings) could then be analysed for salt content by reaction with silver nitrate solution. It may be possible to compare the cloudiness of samples by eye, or if a colorimeter or spectrophotometer is available, a quantitative analysis may be possible.

### Extension 3: Determining the type of fat in crisps

'Contemporary Chemistry for Schools and Colleges' by Vanessa Kind (RSC) details an experiment that can be used to compare the level of unsaturation in different fats and oils. The fat extracted from the pupil's own crisp investigation could be compared with commercially available fats and oils.

[www.rsc.org/Education/Teachers/Resources/Contemporary.asp](http://www.rsc.org/Education/Teachers/Resources/Contemporary.asp)

Also

[www.practicalchemistry.org/experiments/unsaturation-in-fats-and-oils,227,EX.html](http://www.practicalchemistry.org/experiments/unsaturation-in-fats-and-oils,227,EX.html)

### Extension 2: Extraction of oil from sunflower seeds

Many crisp manufacturers are now using sunflower oil to fry the potatoes. It may be possible to extract the oil from sunflower seeds in a similar way to the method used in the crisp experiment. The sunflower seeds could be crushed prior to the solvent extraction process.

## Method of fat extraction from crisps

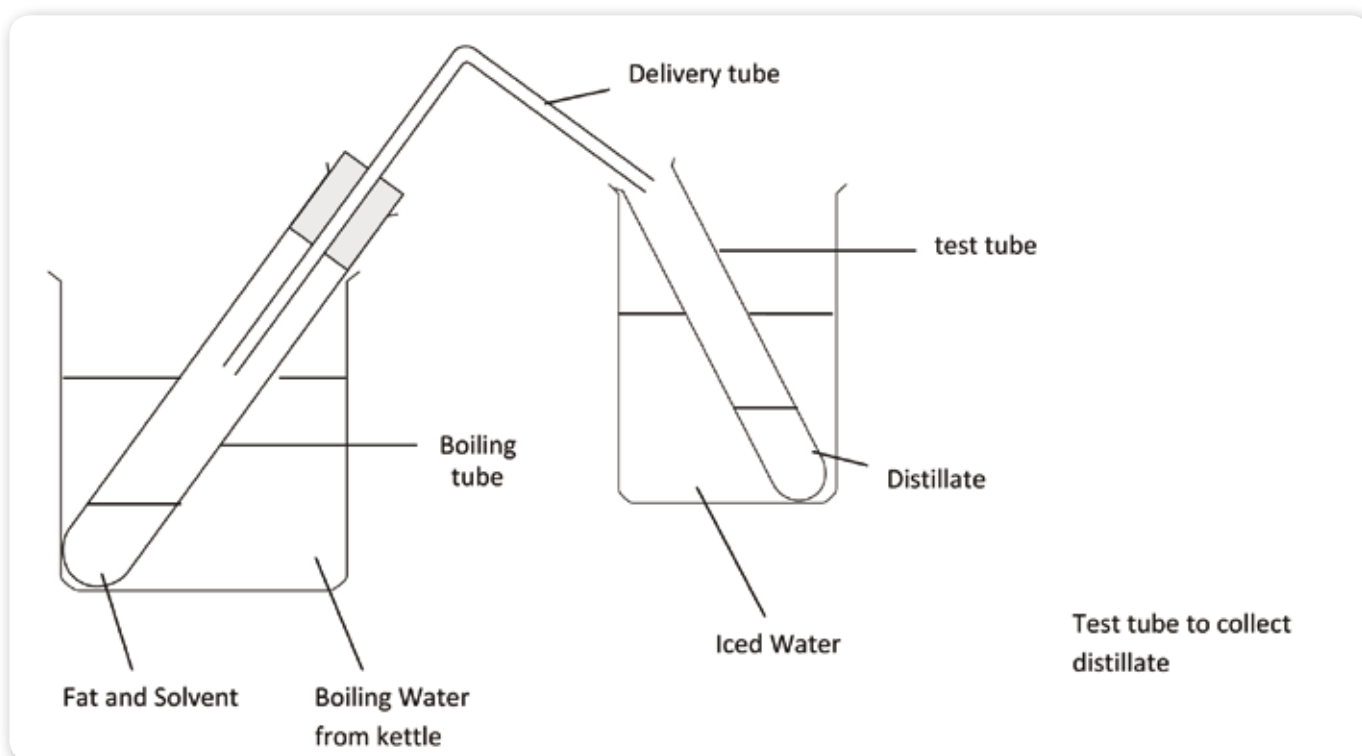
Reproducible results can be obtained using the following general method

### You will need:

- ▶ Boiling tube
- ▶ Delivery tube (glass)
- ▶ Test tube
- ▶ 250 cm<sup>3</sup>, 100 cm<sup>3</sup> beaker
- ▶ Ice water
- ▶ Hot water from kettle (70 °C)
- ▶ Propanone
- ▶ Petroleum ether (40-60 °C)
- ▶ Any other solvent suggested by pupil

### Method:

1. Approximately 1 g of crushed crisps are weighed accurately and the mass noted.
2. The crushed crisps are placed in a test tube (should be approximately half full).
3. Solvent is added so the level in the test tube is approximately  $\frac{3}{4}$  full.
4. A stopper is placed on the test tube and the test tube gently shaken to begin with. The stopper should be removed to allow the release of any pressure and the stopper replaced. The test tube can now be shaken more vigorously.
5. The crisps are filtered through glass wool and the filtrate collected in a boiling tube.
6. The boiling tube containing the dissolved fat and solvent is set up for distillation as shown below.
7. The distillate can be re-used for future investigations.
8. A small volume of petroleum spirit will remain in the boiling tube. This can be removed by pouring the solvent and fat mixture into a weighed crystallising dish and placing on a hot plate (multiple dishes will fit on one plate) for a couple of minutes. Alternatively the solvent will evaporate if left for a few days.



## Health and safety

- ▶ Wear eye protection.
- ▶ Avoid naked flames.
- ▶ Solvents should be disposed of in a waste solvent bottle stored in a fume cupboard during the practical but must be dealt with at the end of the practical.
- ▶ Practical must be carried out in a well-ventilated room.



### Solvents

- ▶ Propanone



Highly  
Flammable



Irritant

- ▶ Petroleum ether (40° - 60°C)



Highly  
Flammable



Harmful



Dangerous  
for the  
environment

- ▶ Any other solvent suggested by the pupil

## Appendix 1 – Outcome descriptors

Outcome number	Outcome description
LIT 3-02a	When I engage with others, I can make a relevant contribution, encourage others to contribute and acknowledge that they have the right to hold a different opinion. I can respond in ways appropriate to my role and use contributions to reflect on, clarify or adapt thinking.
LIT 3-05a	As I listen or watch, I can make notes and organise these to develop thinking, help retain and recall information, explore issues and create new texts, using my own words as appropriate.
LIT 3-06a	I can independently select ideas and relevant information for different purposes, organise essential information or ideas and any supporting detail in a logical order, and use suitable vocabulary to communicate effectively with my audience.
LIT 3-09a	When listening and talking with others for different purposes, I can: <ul style="list-style-type: none"> <li>• communicate information, ideas or opinions</li> <li>• explain processes, concepts or ideas</li> </ul> Identify issues raised, summarise findings or draw conclusions.
LIT 3-14a	Using what I know about the features of different types of texts, I can find, select, sort, summarise, link and use information from different sources.
LIT 3-21a	I can use a range of strategies and resources and spell most of the words I need to use, including specialist vocabulary, and ensure that my spelling is accurate.
LIT 3-24a	I can consider the impact that layout and presentation will have on my reader, selecting and using a variety of features appropriate to purpose and audience.
LIT 3-28a	I can convey information, describe events, explain processes or concepts, and combine ideas in different ways.
HWB 3-15a	I am developing my understanding of the human body and can use this knowledge to maintain and improve my wellbeing and health.
HWB 3-19a	I am developing the skills and attributes which I will need for learning, life and work. I am gaining understanding of the relevance of my current learning to future opportunities. This is helping me to make informed choices about my life and learning.
SCN 3-16a	I can differentiate between pure substances and mixtures in common use and can select appropriate physical methods for separating mixtures into their components.
SCN 3-16b	I have taken part in practical investigations into solubility using different solvents and can apply what I have learned to solve everyday practical problems.
SCN 3-20b	Through research and discussion, I have contributed to evaluations of media items with regard to scientific content and ethical implications.
MNU 3-01a	I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.
MNU 3-07a	I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.
MNU 3-20a	I can work collaboratively, making appropriate use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading.



## Appendix 2 – Group working roles

There are many job descriptions that can be used successfully for group members during co-operative learning methods. Research suggests that if pupils have assigned roles it helps members of the group to know they have an important role contributing to the overall success of the project.

It may also be useful to have a large poster on the wall displaying the job descriptions and to provide badges for pupils to wear during the activities.

- ▶ **Resource Manager** – collects necessary equipment and is responsible for ensuring that it is returned.
- ▶ **Team Co-ordinator** – ensures that all members of the team are carrying out their roles, and are working well together.
- ▶ **Communications Manager** – ensures all team members understand their roles, that all members of the team understand the results of experiments and that all members are included in/participate in discussion. This person may also wish to read out the team notes which are provided at the start of each activity, to ensure all team members understand the task.
- ▶ **Target Manager** – ensures that the team meets all deadlines within the allocated time. It is vital that they leave enough time for discussion of results.
- ▶ **Researcher and Reporter** – summarise the group discussions, and report back to the facilitator/teacher/other teams during class discussions.

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