

# Science Key Stage 4

## Introduction

This new section contains lesson ideas that will be of use in the new specifications for Science at Key Stage 4.

**What's in your drink?** (Analysis of food labels, sort exercise on food additives)

**Finding out what's in your drink** (Practical food tests)

**Food preservation** (Practical lessons on assessing the effect of temperature on food spoilage)

**Which method of food preservation works best?** (Using food labels to evaluate the effectiveness of different food techniques)

**Using different preservation techniques to preserve apple juice** (Practical lessons to plan and carry out an investigation into different preserving techniques)

**Packaging** (Choice of materials related to properties and function)

**Water – keeping a balance** (Maintenance of water balance, and the role of ADH)

**The need for safe water** (Human intervention in the water cycle)

## Activity 1 – What's in your drink?

### Learning objective

Students to analyse food and drink labels and complete a sort exercise on food additives.

### Key vocabulary

additive, antioxidant, artificial sweetener, emulsifier, E number, flavouring, food colouring, preservative, stabiliser

### Organisation

Paired and individual work

### Resources needed

Lemonade

Beakers

Food colouring (blue, green, yellow, red)

'Liquids Mean Life'

'Legislation and Good Practice'

} [TEACHER'S LINK](#)  
[PUPIL'S LINK](#)

Food and drink labels

Access to internet/text books

Worksheet – [What's in Your Food?](#)

### Risk assessment

Normal lab procedure.

### Introduction

Show the students beakers containing lemonade with food colouring added. Explain that they are all drinks. What do you think they taste of? Which looks most appealing? Least appealing? Discuss how the appearance of what we eat and drink affects its appeal.

### Activity

Give out examples of food and drink labels. In pairs, the students are to make a list of additives from the label and try to research what they are and why they are added.

### Plenary

Complete the worksheet 'What's in your food?' sort exercise.

### Extension

Investigate the role of the Food Standards Agency in keeping our food and drink safe.

## Activity 2 – Finding out what's in your drink

### Learning objective

Students to carry out food tests on a sample of drinks.

### Key vocabulary

protein, fat, sugar, Biuret test, Benedict's solution

### Organisation

Practical (group work), Writing (individual work)

### Resources needed

Per group:

Access to water bath (for Benedict's test)

Benedict's solution

Biuret solution

Ethanol

Test tubes, test tube racks

Sample of drinks including yoghurt drink, diet drink, sugary drink, juice (all to be pale colour) and labelled 'Sample A', 'Sample B' etc.

DCPIP (for extension task)

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## Risk assessment

Normal lab procedure. Goggles to be worn for tests. Students to be reminded not to drink samples.

## Introduction

Question and Answer session on parts of a balanced diet. What do we use protein for? Which part of our diet do we use for energy? How can we find out what's in our food?

## Activity

Explain how to carry out food tests for protein, fat and sugar. The students are then to test the sample drinks and write up their experiment, displaying their results in a table.

## Plenary

Discuss the class results and invite the students to guess what type of drink each sample might be.

## Extension

Students can analyse the drinks for the presence of Vitamin C using DCPIP.

## Activity 3 – Food preservation

### Learning objective

Students to assess the effect of temperature on food spoilage (two lessons).

### Key vocabulary

enzyme, activity, food spoilage

### Organisation

Group work

### Resources needed

Apple juice  
Test tubes  
Cotton wool  
Access to refrigerator and freezer

### Risk assessment

Normal lab procedure. Students to be warned not to taste the apple juice.

### Introduction

Show students a carton of apple juice. Read out the best before date. What does this mean? Could I make this apple juice last longer? Ask for suggestions. In which conditions will it go off

quickest? How can you tell if it is spoiled? Explain that drinks will go cloudy as the microbes reproduce.

### Activity (Lesson 1)

In groups, the students should plan and carry out an experiment to see how temperature affects the spoilage of apple juice. They should also set out a timetable where they can check their results every few days, noting any changes. This could take up to three to four weeks.

### Plenary

Discuss, as a class, the methods groups have chosen to adopt. Discuss whether this is a fair test. Allow time for the groups to adapt their methods based on the comments of the groups.

### Extension

Students are to predict how long each different experimental set-up will last, justifying their prediction with scientific knowledge.

### Activity (Lesson 2 – approximately 3 – 4 weeks later)

Students are to assess the outcomes of their experiments, write up their results and come to a conclusion about which method preserved the juice for longest.

### Plenary

Collate the class results. Discuss the results, then explain the science behind their findings and emphasise that the results should be put into practice, that is, how to store perishable food safely.

### Extension

Work out a home routine so that stored food is regularly checked and food spoilage is kept to a minimum.

## Activity 4 – Which method of food preservation works best?

### Learning objective

Students to use label information to assess the effectiveness of food preservation.

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## Key vocabulary

UHT, pasteurisation, canning, preservatives

## Organisation

Individual research

## Resources needed

Samples of different fruit juices i.e. long life, fresh, pasteurised, canned, frozen

## Risk assessment

Normal lab procedure or, if tasting is being carried out, it must be in a food technology room or area where drinking is permitted.

## Introduction

Show the students the different containers of fruit juice. What is the difference between these drinks? Write suggestions on the board.

## Activity

Distribute the containers. The students should then compare the information on the labels to find out the differences. Discuss their findings. Explain the different preservation methods. In pairs, the students should use their knowledge of microbes to discuss why each method might work.

## Plenary

The students could then take part in a blind taste test to see if they can tell from the taste how the drink has been treated.

## Extension

In groups, the class should research into a different method of food preservation e.g. irradiation, and then peer teach the rest of the class.

## Activity 5 – Using different preservation techniques to preserve apple juice

(Two lessons)

### Learning objective

Students to plan a fair test to compare the effectiveness of different preservation techniques.

## Key vocabulary

canning, bottling, salting, pickling, pasteurisation, UHT

## Organisation

Group work

## Resources needed

Fresh apple juice (no preservatives)

Vinegar

Sugar

Salt

Test tubes

Cotton wool

Aluminium foil

Bunsen burner

Thermometer

## Risk assessment

Normal lab procedure. Students to be warned not to taste the apple juice. Goggles to be worn if Bunsen burners are to be used.

## Introduction

Board blast ways of preserving food. Which method is most effective? Ask students to put the methods in order of effectiveness i.e. which should keep food safe for longest.

## Activity (Lesson 1)

Explain how each method of food preservation works. The students are then to try to preserve apple juice using a variety of methods – adding sugar, salt, vinegar, heating up to 60°C (pasteurisation), heating above 100°C (UHT), then sealing tubes with cotton wool and wrapping the top with aluminium foil. The test tubes should then be left in a warm place for a week.

## Plenary

Students are to predict which sample will be preserved best and try to explain why.

## Extension

Students could extend this investigation by experimenting with varying amounts of each preservative.

## Activity (Lesson 2)

Students are to record the results of their experiment and write this up. They should then discuss other factors that affect food preservation i.e. change of taste and therefore why many methods are unsuitable for use.

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## Plenary

Discuss the importance of using chemical preservatives for some food and drink so that the products will be safe and their taste and appearance remain unchanged.

## Activity 6 – Packaging

### Learning objective

Students to make the link between choice and properties of material to the material's use. They are to consider the practical and ethical issues of recycling.

### Key vocabulary

material, properties, composite, recycle, re-use

### Organisation

Practical (group work)

Written work (individual work)

### Resources needed

Examples of drinks containers (pictures or containers)

Copies of worksheet – [Packaging](#)

Access to the internet (for extension task)

### Risk assessment

Normal lab procedure.

### Introduction

Ask the students to write down a list of the properties needed for a drinks container. Collect their ideas on the board. These could include convenience of opening, weight, being waterproof.

### Activity

As a practical exercise, the students should examine different drinks containers and then fill in the table on the worksheet. Help may be given in identifying metals, and also students should be introduced to the idea of composite materials.

Discuss recycling in the local community and the barriers that prevent people from recycling. How might barriers that prevent recycling be reduced?

In groups, students should formulate a 10 point plan that they would adopt if they were local councillors to improve the rate of recycling.

## Plenary

Students should present their plans to the class and their ideas should be voted on.

## Extension

See worksheet – [Packaging](#).

## Activity 7 – Water – keeping a balance

### Learning objective

Students to understand and recall how we maintain our water balance and how factors affect this.

### Key vocabulary

respiration, kidney, skin, ADH, hypothalamus

### Organisation

Discussion, mind map (class work)

Written exercise (individual work)

### Resources needed

Copies of worksheet – [Water balance](#)

### Risk assessment

Normal lab procedure.

### Introduction

Write on the board 'Water'. Using the students' suggestions, build up a mind map on the importance of water to us. Ask the students to consider what would happen if we didn't have enough water. Remind them that this is the case in many places.

### Activity

Explain how our bodies gain water (food, drinks, respiration) emphasising the need to drink 2 litres of fluid a day. Ask for ways that we lose water. Introduce environmental factors (temperature, humidity) and increased exercise. What effect do these have on water balance?

Students are to make notes on how sweating cools us down.

Explain the role of the kidney and ADH in regulating the urine output to maintain water balance or alternatively, set a research exercise.

Students are to complete the worksheet.

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## Plenary

Discuss the answers to the worksheet.

## Extension

Find out how animals and plants have adapted to very dry conditions.

## Activity 8 – The need for safe water

### Learning objective

Students to appreciate the need for conserving water and to recall the steps involved in making water safe to drink and use for food manufacture.

### Key vocabulary

conservation, filtration, sedimentation, chlorination, contaminants

### Organisation

Group work, individual work

### Resources needed

'Liquids Mean Life' poster  
Text books/access to internet for research

### Risk assessment

Normal lab procedure.

### Introduction

Ask: the class If your water supply was cut off for a day, where would you get your water from? For a week? For a month? Board blast ideas. What would be your priorities for using water? How could you reduce your water use? Show the students the poster and revise how water is recycled naturally through the water cycle.

### Activity

In groups, the students are to discuss human intervention in the water cycle. They should make a list of how we use water and the possible pollutants that humans may add to water as we use it (at home and in industry).

Students are then to research how water is purified and produce a poster explaining the processes.

## Plenary

Ask the students to commit to conserving water for the next week and keep a water diary. Share ideas generated from the introduction of the lesson.

## Extension

Research into how sea water is being used to provide drinking water and the advantages and disadvantages of the process.

