Handouts for developing DARTS

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Handout 2.3

How fresh is fresh?

You may have noticed that the supermarkets sell apples and other fruits all the year round. Apples ripen in England in the autumn. Once ripe, they last up to a week or two. Apples are imported from other countries such as New Zealand to extend the season, but this alone will not make sure that you can have an apple at any time of the year. Many apples are picked just before they are ripe and then stored in a controlled environment. When stored carefully, some varieties of apple can last up to 12 months. So the apple you buy could be a year old.

How can you store an apple so that it will stay fresh? As apples ripen, the minerals and other chemicals in the cells that make up the apple tissue change. Starches in the cells change to sugars and the cell walls begin to break down, so when you bite into the apple it tastes sweet and juicy. If you want to keep an apple for longer you need to make sure it does not ripen too soon. You do this by picking the apple at the right time and then by storing it so that it ages slowly.

You can check how close apples in an orchard are to being ripe by testing one or two to see how much of minerals such as phosphorus, magnesium and potassium they contain. Cell walls need some of these minerals to maintain their rigidity. As the apple ripens, so the amount of each mineral in the fleshy part changes. By tracking the changes you can tell how ripe an apple is. Picking the apple at just the right time makes sure it will last longer.

Once picked the apple will continue to ripen, so this process needs slowing down. An apple is living and each of its cells continues to respire. This means that they continue to absorb oxygen from the air and give off carbon dioxide. As each cell respires, some of the stored food is converted to energy. The apple also gives off a gas called ethylene that helps to ripen the fruit. Controlling the atmosphere in the store can slow down the respiration rate in the apple cells. A slow-turning fan can keep the air circulating and blow away the ethylene as it is formed. If you decrease the level of oxygen and increase the level of carbon dioxide then cell respiration slows. Some varieties of apple will tolerate high levels of carbon dioxide in the atmosphere. For instance, Cox apples will tolerate 9% of carbon dioxide. These varieties can be stored for longer. Apples such as the Worcester will tolerate less, so cannot be stored for long periods.

The apple store is also cooled. This makes sure that any chemical reactions, such as respiration, will take place at a slower rate than normal.

Fruit such as apples cannot be frozen without becoming softer and mushy. This is because, as the water in the cytoplasm freezes, sharp crystals of ice form that burst the cell membranes and cell walls. As water freezes to form ice it expands, and this will also cause the cell walls and cell membranes to burst.

Growing and selling apples and other fruits is big business, so it is in the interests of many to extend the shelf life of these products as long as possible. But do they taste the same as freshly picked apples? The industry claims they do. If you are lucky enough to live in an apple-growing area you could try your own experiment, but you may have to wait until next autumn.

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Handout 2.5

Directed activities related to text (DARTs): a summary

Reconstruction activities **use modified text**. Pupil tasks: completion-type activities with deleted or segmented text.	Analysis activities **use straight text**. Pupil tasks: text marking and labelling or recording.
1 Text completion Pupils predict deleted words (cloze), sentences or phrases.	***1 Underlining*** Pupils search for specific target words or phrases that relate to *one* aspect of content, e.g. key words.
2 Diagram completion Pupils predict deleted labels on diagrams using text and other diagrams as sources.	***2 Labelling*** Pupils label segments of text which deal with different aspects, e.g. labelling a scientific account with labels provided by the teacher such as *prediction, evidence, conclusion.*
3 Table completion Pupils complete deleted parts of a table using table categories and text as sources of reference.	***3 Segmenting*** Segmenting of paragraphs or text into information units. Labelling of segments of text.
4 Completion activities with disordered text (a) Predicting a logical order for a sequence. (b) Classifying segments according to categories given by the teacher.	***4 Diagrammatic representation*** Constructing diagrams from text, e.g. using flow diagrams, concepts maps, mind maps, labelled models.
5 Prediction Pupils predict next part(s) of text with segments presented in sequence.	***5 Tabular representation*** Pupils construct and represent information in tabular form, extracting it from a written text.

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Handout 2.7

Text marking (analysis) grid

How can ripening be slowed?	What process does it stop?

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Handout 2.8

Table completion (analysis)

Statement		Explanation
Apples are imported from other countries such as New Zealand	**because**	
When you bite into a ripe apple it tastes sweet and juicy	**because**	
The apple store is cooled	**because**	
Levels of oxygen are decreased	**because**	
You cannot use freezing as a method to store apples	**because**	
An unripe apple contains phosphorus, magnesium and potassium	**because**	

Handout 2.9

Cells

Almost all cells have a nucleus which is suspended in a jelly-like fluid called cytoplasm. This cytoplasm is contained within a membrane that lets some substances in and out.

Cells can be different in shape, size and colour. This is because they do different jobs. Sperm cells have a small head and a long, lashing tail. Their job is to fertilise an egg cell. They have to swim to the egg; the head carries the genetic material. A palisade cell is found in the upper parts of a leaf and is green. The green colour is due to chlorophyll, a chemical that helps plants to photosynthesise. The job of a leaf cell is to produce glucose from carbon dioxide and water using energy from the Sun. A root hair cell is long and thin and so has a large surface area. Its job is to absorb water and minerals from the soil. Nerve cells have a small region which contains the nucleus and most of the cytoplasm. Other parts of the nerve cell can be very long and thin and even be shaped like the branches and twigs of trees. Their job is to pass on messages, in the form of electrical signals, to different parts of the body. For example, if your hand is burned in a flame, nerve cells would transmit messages from your hand to the central nervous system in your spine and then back to your arm muscles to pull your hand away from the flame.

So whilst all cells have the same features, such as cell membrane, nucleus and cytoplasm, what they look like can be very different. Their form and what extra they contain, such as chlorophyll or haemoglobin, helps them to perform different functions.

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Handout 2.11

Teacher guidance sheet: Cells

Suggested activities

1 Text analysis (DARTs)

(a) Pupils can be asked to consider the text. For instance, they could be asked to:

- underline in BLUE all words that identify different types of cells;
- underline in RED all phrases that identify their function;
- underline in GREEN all phrases that identify the structure of the cell.

(b) As a follow-up activity, pupils can be shown how to WRITE sentences which EXPLAIN the link between structure and function using connectives which indicate cause and effect (see connectives handout in *Literacy across the curriculum*, section 3).

You could provide a sentence structure indicating connectives, such as the structure of BLUE have GREEN because/as RED:
e.g. *Sperm cells* have *small heads and long, lashing tails* because *they have to swim to the egg to fertilise it.*

2 Group reading leading to a writing activity

Pupils are asked to read a piece of text. In groups they then discuss the text. They might 'mark' it, for example use highlighting to identify features such as key words to do with names of parts of a cell. Pupils then, individually or as a class, write about an aspect of cells using the key words and information from the text.

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Handout 2.13

Sequencing activity (restructuring)

Slowing down respiration

Pupils are provided with a fragmented paragraph on cards and are asked to sequence the text to re-form the paragraph. Doing this will not only help pupils to develop a better understanding of respiration but also help them to formulate ideas about how to construct a logical argument.

Once picked the apple will continue to ripen, so this process needs slowing down.	An apple is living and each of its cells continues to respire.
This means that they continue to absorb oxygen from the air and give off carbon dioxide.	As each cell respires some of the stored food is converted to energy.
The apple also gives off a gas called ethylene that helps to ripen the fruit.	Controlling the atmosphere in the store can slow down the respiration rate in the apple cells.
A slow-turning fan can keep the air circulating and blow away the ethylene as it is formed.	If you decrease the level of oxygen and increase the level of carbon dioxide then the cell respiration slows.
Some varieties of apple will tolerate high levels of carbon dioxide in the atmosphere.	For instance, Cox apples will tolerate 9% of carbon dioxide.
These varieties can be stored for longer.	Apples such as the Worcester will tolerate less so cannot be stored for long periods.
The apple store is also cooled.	This makes sure that any chemical reactions such as respiration will take place at a slower rate than normal.

Pupils can be asked to think of a title for their reconstructed paragraph.

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Handout 2.14

Diagrammatic representation (analysis)

Apple store

In this example of locating information, pupils are asked to convert text to labels.

Draw a box to represent the apple store. Label it with the features that make it a good store to keep apples.

Apple store

Handout 2.15

Pupil sheet 1

To tell an acid from an alkali

You can group substances according to whether they are acidic, neutral or alkaline. But what does that mean? We all have an idea about what acids are and perhaps even what alkalis are. If you stopped someone in the street and said, 'What is an acid?', the chances are they would say it is something that burns you. Lemon juice contains an acid, so does vinegar. These substances do not burn, so this cannot be the whole story. We need a better way to tell what an acid is as well as ways of describing alkalis.

Acids and alkalis only really behave as acids or alkalis when they are in water. In the laboratory you use them diluted in water. Have you ever looked at them closely? They often look the same – colourless transparent liquids. So what are they and how can we tell them apart?

As it said before, lemon juice and vinegar both contain acids, so too do sour milk, limes, oranges and apples. Sour apples contain more acid. Does this give you your first clue? All these examples have something in common that is true of all acids. They all taste sour; they have a sharp taste. You would not want to taste acids such as sulphuric acid or nitric acid because these are harmful, even when diluted. When they are concentrated (more acid to less water) they are ***corrosive***. What does this mean?

Corrosive means that the acids react with substances such as metal or skin cells. When this happens you can often see fizzing and things can get quite hot. This heat is a result of the chemical reaction. If concentrated acid is spilt on skin it can cause a burning sensation. So perhaps this is where the idea of 'burning' comes from. It is quite wrong, however, to say that acids burn. Burning happens in fires; it is a reaction between things such as fuels and oxygen.

Another property of acids is their ability to react with metals. Diluted acids react with many metals to form solutions and release bubbles of hydrogen gas. Acids also react with some rocks such as limestone. This is because rocks such as limestone contain calcium carbonate. You can see the reaction taking place as a 'fizz'. The fizz is carbon dioxide gas being released.

Did you know that normal rain water is slightly acidic because it contains dissolved carbon dioxide? Carbon dioxide in water is called carbonic acid, and of course acids attack limestone rocks .... So the cycle continues.

Handout 2.16

Pupil sheet 2

To tell an acid from an alkali

Alkalis are quite different from acids but they can also be corrosive. Sodium hydroxide and ammonium hydroxide are two common alkalis. If you spilt alkali on your skin it would feel soapy, because the alkali sets about dissolving the fat on and in the skin (another chemical reaction). This makes alkalis quite useful as cleaners. Oven cleaner sprays often contain sodium hydroxide. Alkalis are also used in the manufacture of soaps. Another useful alkali is potassium hydroxide which is sometimes used in the production of fertilisers.

Alkalis are therefore also corrosive. Like acids, they can react with metals and skin but they react in different ways. Alkalis can be just as harmful as acids, and they are even more harmful to eyes than acids. Indeed, our bodies are designed to cope with acids better than with alkalis. Did you know that the sweat from our skin is slightly acidic and that our stomachs contain hydrochloric acid to help with the digestion of food?

So how can we tell the difference between acids and alkalis? It would not be sensible to rely on taste or on a soapy feel to the skin. Luckily there is a better way. Extracts from some plants can be used to make indicators. These indicators often go red or yellow in acidic solutions and blue or violet in alkaline solutions. Litmus is an example which is made from a lichen. It turns red in acidic solutions and blue in alkaline solutions. You can also make your own indicator from red cabbage. Universal indicator is commonly used in the science laboratory. It is made from a mixture of compounds and will turn red, orange or yellow according to the strength of the acidic solution, red indicating the strongest acidic solution.

Even though acids and alkalis are both harmful, when you mix them together in the right proportions you can end up with a neutral substance that is no longer corrosive and is less harmful. The chemical reaction that occurs between acids and alkalis is called neutralisation. The resulting neutral solution will turn a universal indicator green. So we have a way to tell an acidic solution from an alkaline one, and from a neutral one, using indicators.

A final thought – have you noticed anything about the naming of acids and alkalis? Look at the names above. Can you spot a pattern? Can you tell an acid from an alkali by the way it is spelt?

Handout 2.17

Teacher guidance sheet

To tell an acid from an alkali

Suggested activity

Ask pupils to work in pairs and read either the article on handout 2.15 or the one on 2.16. They should then use an A3 sheet of paper to summarise what the article says about acids and alkalis. They should start by putting the words *'acid'* and *'alkali'* in the middle of the paper. Ask pupils to then produce either a concept map or a mind map with information from the article.

Display the cognitive maps and discuss similarities and differences with the pupils. Match this information to the text.

This is likely to be an effective learning activity because:

- pupils have shared the work so have refined and clarified ideas as they work;
- they have supported each other in the activity, hence they are not exposed;
- they have begun to make links between concepts;
- the exercise permits the teacher to assess the level of understanding;
- the final A3 sheets can be displayed to support further learning through the topic;
- the map can readily be used as a process for the start of another text type, such as a talk;
- the concept mapping ensures a variety of learning styles other than straightforward note-taking.

Next step

Use the same text with a different group and try one of the other suggested activities from the active reading and shared reading sessions.

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