Teacher notes - Food tests

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Aim

This experiment allows students to practice many of the achievement standards prescribed in the curriculum.

This investigation uses types of food that students likely consume. This makes the experiment very exciting as students will be able to test for themselves the components (macronutrient composition) found in their meals and decide whether they are healthy or not.

According to the level of the students, the teacher may choose the extent of information and details of each step that are given to the students.

By the end of this experiment, students would gain insight on how to analyse data and apply their scientific knowledge to evaluate claims made by others.

Plan

The experiment has been planned for the students as the procedures used to test for different types of nutrients are complex and a number of chemicals are involved; however students are able to choose the food item to investigate.

It is a good idea to set homework for the students to search for the nutrients contained in different types of food a week before the experiment. Each group will decide which types of food they will investigate and the teacher will decide on the suitability of the food chosen by students.

The teacher may like to ask the students to write the safety precautions that should be taken and discuss it with them before doing the experiment. This ensures they are aware of any hazards they might face and how to avoid them.

The issue of food allergies must also be taken into account, depending on the individual needs of your students.

Conduct

The experiment is mostly a guided inquiry with a bit of open inquiry. Students will be given the question, the plan and how to conduct it but they will be asked to analyse the data and make conclusions on their own.

Students will conduct a number of chemical processes to test for glucose, starch, lipids and proteins.

Make sure the students are aware of the safety precautions while using glassware, Bunsen burners, chemicals and food material for which some students could be allergic. We encourage spending time with the students to discuss the safety issues including wearing goggles, holding hot test tubes with a test tube holder and reporting any glassware breakage.

Make it clear that students should label their test tubes with the type of material they are testing.

Consider allowing students to watch a video before conducting the experiment in order to engage them and give them an idea on what they are expected to do and observe. A video that shows a number of tests for Iodine, Biuret and Benedict can be watched on the following link: https://www.youtube.com/watch?v=sLP8dcnWnJg

Ask students to take photos of all the steps in the experiment to include in their final report.

1. Benedict's Solution test
   Benedict's test is used to confirm the presence of reducing sugars. All monosaccharides e.g. glucose, fructose and galactose are reducing sugars as well as most disaccharides. However sucrose which is a disaccharide is not a reducing sugar. Sucrose is mainly found in commercial food such as jams, cereals, soft drinks, ice cream and flavoured yogurt. If students chose to test any of these commercial foods using Benedict's solution, they might not get the expected colour change.
   Depending on the amount of sugar present, students can get one of the below colours, ideally they should obtain the brick red colour.

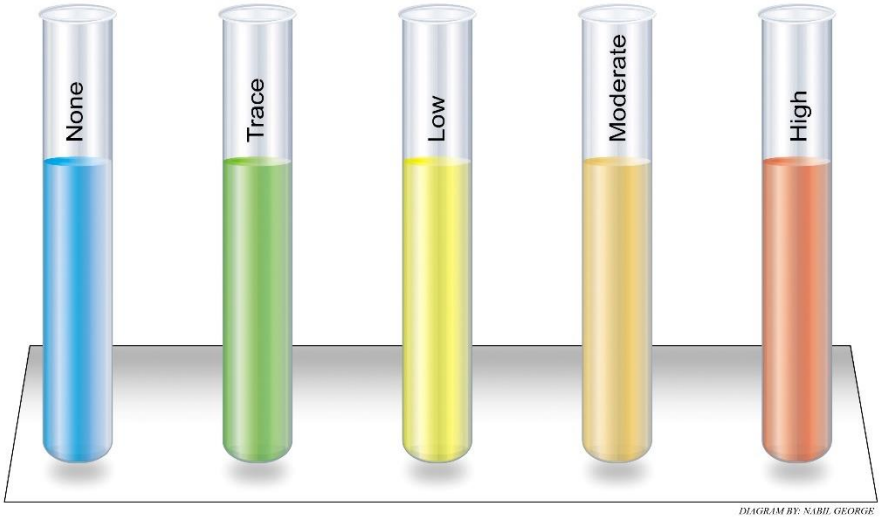


Figure 1: Expected observations for Benedict's test solution

Table 1: Observation and interpretation of colour change for the Benedict test

Observation	Interpretation
No colour change (remains blue)	
Green	
Yellow	
Orange	
Brick red	

2. Iodine test

   This test is used to test for starch found in food. Starch is a carbohydrate consisting of many glucose molecules bound together by a glycosidic bond. It is a tasteless white substance found widely in plant tissue such as potatoes.

   A positive test should change the colour into dark blue/black.

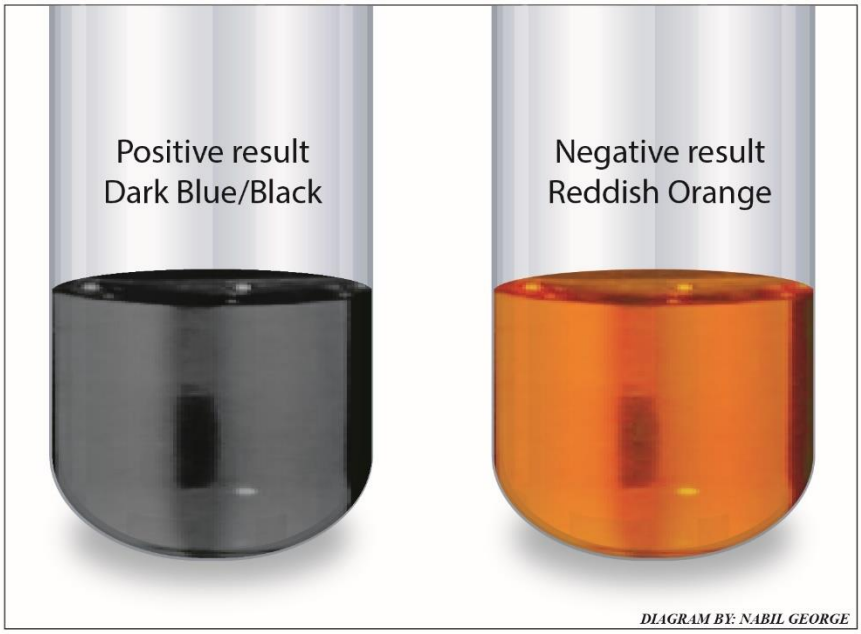


Figure 2: Positive and negative results of iodine test

3. Biuret test

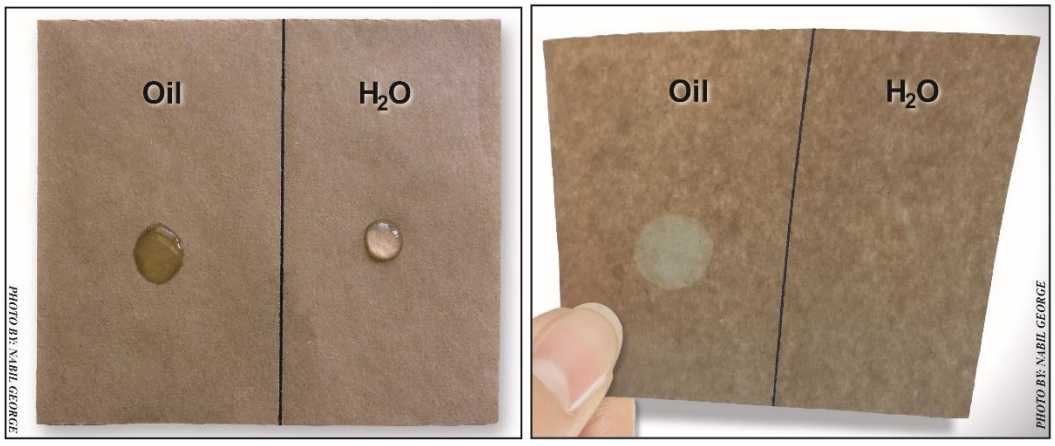
   Biuret's test is used to test for protein which is found in meat, egg and dairy food. The presence of protein would yield a purple/violet colour.

Figure 3: a positive Biuret test

4. Brown paper test

   This test is used to test for lipids. Lipids are a class of organic compounds that includes fats, fatty acids and steroids. Lipids are found in oil and butter.

   To test for lipids, press the food containing lipids against brown paper. This will lead to the brown paper becoming translucent as shown in the figure below.



(a) (b)

Figure 4: Brown paper test (a) Straight after drops of oil and water are placed on the brown paper. (b) After the drops are absorbed

Analyse

Students will tabulate their results in a manner similar to the table below.

Table 2: Observations of the four tests.

Test	Control		Food 1		Food 2		Food 3		Food 4	
	Initial colour	Final colour	Initial colour	Final colour	Initial colour	Final colour	Initial colour	Final colour	Initial colour	Final colour
Benedicts solution										
Iodine test										
Biuret test										
Brown paper test										

Accordingly, students will fill table 2 in the student notes stating the substances present in each sample they have analysed.

Problem solving and discussion

There are a number of things that should be discussed. One important issue that students may face is the colour of the food material they started with, because if it is the same colour as the expected colour change it would not be easy to confirm if the food contained the substance they tested for or not.

Also, the size of the food material affects the extent of colour change. For example, in the Benedict's test as shown in figure 1, students may get different colours according to the amount of reducing sugar present.

Students in year 7 and 8 could be asked to evaluate the results obtained by their peers from other groups using their own scientific knowledge. Things they can evaluate is which variables did their peers change and which variables did they keep constant and how would their choice affect the validity of the results.

For year 9, this could be extended further to investigate inconsistencies in results and relate any inconsistency through analysing what might have gone wrong in the method used. They might also search some of the chemical reactions happening and add it to their final report.

Year 10 could be asked to investigate more details such as at which temperature did the Benedict's test start to show a change in colour. They can also use a stop watch to investigate the rate of reaction for different tests and draw a plot showing the time taken for each reaction to happen. Year 10 students should be able to explain any sources of uncertainty and evaluate the validity and reliability of their results.

***A fun extension could be for the class teacher to create a free account at https://cronometer.com/. This website allows the user to enter various food items to get their macronutrient breakdowns. This is represented as a pie-chart in the Calories Summary section of**

the site. Students can explore the site, entering their food items to see if they got consistent results.

Conclusion

This experiment is a good opportunity for students to achieve analytical standards and to observe how chemical reactions happen at different rates. It is very helpful in understanding how changing variables can affect the results.

The Australian Guide to Healthy Eating info-graphic can be obtained from:
https://www.eatforhealth.gov.au/food-essentials/five-food-groups

Students may be able to conclude that the five food groups also represent different macronutrients, such as starch in the form of grains, sugars in the form of fruit, proteins and fats in the form of meat and dairy.

Can the students make a statement as to whether the various food items that they chose combine to make a balanced meal?

Students can represent this experiment as a poster which will include tables, and photos.

Link to photo