

Teacher Notes

Role of Teeth

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Aim

This investigation is designed for students to learn about the role of teeth through studying how the concepts of surface area and rate of reaction applies to its function in digestion. Students enjoy this experiment as it gives them a real world example of these chemistry principles.

The digestion process starts in the mouth where both mechanical and chemical digestion takes place. Digestion is the process through which food is broken down into simpler forms for the body to absorb and make use of.

Mechanical digestion is a physical process where food is broken up into smaller pieces, whereas chemical digestion involves the action of different chemicals breaking certain bonds within the food molecules in order to change them into the simplest form possible.



Figure 1

Plan

This investigation involves the use of Alka-seltzer tablets. These tablets are quite safe but we can't ignore the unlikely possibility that some students might be allergic to any of its components. Therefore, discuss with students the necessity of wearing gloves during the course of the experiment.

Discuss with students the safety precautions that should be taken while using glassware and how they should report any breakage. Also, make them careful when handling the mortar and pestle, as these heavy objects can cause injuries.

Something that students need to think about is how to be accurate when measuring and how to control for other factors that need to be kept consistent for each test. This includes the amount of water in which the tablet is dissolved, the temperature of the water in all the beakers, the time taken to submerge the whole tablet in water, the initial mass of the tablet and ensuring that the time is measured correctly.

Depending on the class level, the teacher may choose to discuss more or less of these factors.

Students can be asked to give their thoughts on how to place the tablets within the water at the same time to ensure correct timing. The options available:

1. Place the water in the beakers. Count from one to three then drop the tablets, use one stop watch and write down the time when each tablet is completely dissolved. Four students are required to drop the four tablets. Problems include reaction time of different students and the time taken to drop the crushed tablet (this could take longer time than dropping the other tablets).
2. Place the four tablets in the beakers and on the count of three pour the measured amount of water in the beakers, use one stop watch and write down the time when each tablet is completely dissolved. Again, you require four students to pour the water and the problem still is in the differences of their reaction times.
3. Do the experiment separately and drop one tablet in the water at a time. One student can be responsible for dropping the tablet each time and one student for handling the stop watch in order to reduce the variation in reaction times. This method requires a longer time.

Conduct

This experiment is a mix between guided inquiry and prescribed inquiry, where students are given the main steps of the method and they then design the details of each step in order to conduct the experiment.

Students will find the time taken to dissolve the Alka-seltzer tablet in water. They will study the effect of surface area on the rate of the tablet dissolving. By rate, we mean how fast it is dissolved. They will use a whole tablet, a halved tablet, a tablet in quarter pieces and a fully crushed tablet.

Depending on the level of the class, the teacher may like to extend the method. For more advanced classes, a step to measure the temperature of water and the mass of the tablet before placing it in water may be added.

Analyse

Students will tabulate their results

Size of tablet	Time taken to dissolve (min)
Whole	
Half	
Quarter	
Ground	

For more advanced classes

Size of tablet	Mass of tablet (g)	Temperature of water (°C)	Time taken to dissolve (min)
Whole			
Half			
Quarter			
Ground			

Problem solving and discussion

Students will discuss their observations: they will discuss whether the results agreed with their hypothesis that as the size of the tablet gets less, the time to dissolve decreases.

If the results do not agree, students have to think about what has likely gone wrong, for example was it a human error in calculating the time or in keeping all the control variables controlled?

For more advanced classes, if there is a variation in mass between the different tablets, students can practice some mathematical skills as follows:

Tablet size	Tablet mass (g)	Time to dissolve (s)	Time taken /gram (s/g)
Whole	M1	T1	T1/M1
Half	M2	T2	T2/M2
Quarter	M3	T3	T3/M3
ground	M4	T4	T4/M4

This will minimise the different tablet masses being a factor that affects the results. Students can then plot a curve to show how the time/gram varies with the tablet size. This is a more accurate measure of the effect of surface area on the reaction rate, as mass has been averaged out.

Students should discuss what may have gone wrong and how to avoid mistakes if the experiment is repeated.

Conclusion

Students will summarize their findings and state whether their initial hypothesis is supported or not.

They can represent their findings in a poster and choose an interesting title for their experiment, such as "Is it worth it to crunch a chemical into a fine powder!!!"

References

Figure 1: Author al Gazmen <https://www.flickr.com/photos/guccibear2005/193848057/in/photolist-i8wgT-6h9hmR-nMBMSn-76Awn4-dSGAo3-5hDNJR-8yGpmd-6iPUQx-5FfpAA-fEMmT-7Md8Mo-8FxVL3-nZ77Vm-8pe83r-8hGyi-poFmEn-9fGJ1u-754QYX-5noJ6w-6zZHoG-dcpMh3-nV7A2f-bYC4bN-oJmZW-5q3aKm-pa86QW-5J8HC7-8AWJYd-YwP7s-7FmX8j-4wmiY6-5fX2cW-2ordmc-9ht81d-bJX6U2-4sdS9v-4Sb4Ay-N7WPz-4UMMW3-9mVjWM-2z2pKC-4BwKka-9T9Kxc-782rST-6cRRcZ-dGZb1C-67fhNJ-7X2aSg-eqUrJh-8jH9SM> Licence <https://creativecommons.org/licenses/by-nc-nd/2.0/>