Web Activity: Web Quest—Teflon: Healthy or Hazardous?
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Teflon® was discovered by accident by Roy J. Plunkett at DuPont while researching refrigerants during the 1930s. Plunkett was experimenting with tetrafluoroethylene (TFE) gas and hydrochloric acid in the hope of producing a new refrigerant. During his lab work, Plunkett found a TFE container wouldn't release the TFE gas even though it felt full by mass. When he finally cut open the container, he found that it contained a large amount of a waxy white powder. This powder turned out to be polytetrafluroethylene (PTFE). Testing showed that PTFE was extremely unreactive and wouldn't dissolve in known solvents, wouldn't react with most chemicals, had a very low coefficient of friction, and resisted the growth of mould and fungus.

Within a few short years, PTFE, trademarked as Teflon, was widely used in commercial applications such as for parts that wear like bearings, pump components, and valves. As well, it went into wide distribution in commercial food processing. For example, Teflon coatings on bread pans and muffin tins kept the dough from sticking to the pans more effectively and it less was costly than using grease or oil coatings. It should be noted that DuPont was cautious about releasing Teflon® coated products to the public, as there were concerns that misuse might lead to injuries and lawsuits.

Currently, most cookware is coated with Teflon or some other kind of non-stick surface, and many people can't image cooking without it. Cookware of the past required a coating of oil or grease to keep items from sticking. With today's concerns over fat content in food, many cookbooks suggest eliminating the fat from cooking by using Teflon-coated cookware.

Task
Your group will create a PowerPoint (or similar) presentation to be delivered at the Food and Lifestyle tradeshow. This presentation, which will be about 10 min long, will state your decision as to whether or not Teflon should continue to be used in non-stick cookware. Your presentation will include information on the pros and cons of using both Teflon cookware and alternative cooking materials such as aluminum, cast-iron, and steel.

Your team must provide the Food and Lifestyle tradeshow with:
- a ten-minute audio-visual presentation summarizing the pros and cons of using Teflon non-stick cookware over alternative cookware materials from a health perspective and
- a recommendation concerning the continued use of Teflon in non-stick cookware.

Process
1. Follow your teacher's instructions to form groups or teams. Each member of the group should be assigned a different task, such as researching an alternative to Teflon or creating slides.
2. In your group conduct research on the following:
   - the pros and cons of using Teflon in non-stick cookware.
   - alternatives to Teflon

   Divide the work fairly among the members of your group.
3. When research is complete, meet with your group and consider all of the information you have found. Look at Teflon from a variety of perspectives. If your teacher has not already assigned you a point of view, decide now which perspective you will support.
4. Assemble your research to into your illustrated presentation. Your team's PowerPoint presentation should include the following:
   (a) a slide introducing the purpose of the presentation, the group, and the types of cookware (including Teflon) that you will be discussing;
   (c) one or two slides explaining the science and technology behind Teflon production, including chemical reactions;

(d) one or two slides describing the properties of chemicals involved with Teflon production including tetrafluroethylene (TFE), perfluorooctanoic acid (PFOA), and polytetrafluoroethylene (PTFE);
(e) one to two slides discussing the pros and cons of using Teflon-coated cookware, including information on the chemicals released from Teflon, and under what conditions this occurs;
(f) one or two slides discussing the pros and cons of using other cookware and the oils required in cooking with them, including information on the health consequences;
(g) a summary slide stating the decision of the group including the major reasons that influenced your choice.

5. Present your findings at the Food and Lifestyle tradeshow (i.e., to your classmates).

Resources

You might like to start you research at these sites and then find some of your own resources.

Learn More About Cookware with Teflon® Non-Stick Coatings
This is DuPont's statement on Teflon Safety Concerns. DuPont is the primary manufacturer of Teflon® and has a lot of information surrounding the use of Teflon®.

Wikipedia: Polytetrafluoroethylene
Wikipedia provides extensive information on Polytetrafluoroethylene, or PTFE. There is also a link to information on perfluorooctanoic acid (PFOA). This is a chemical used in the manufacture of Teflon® and is produced when Teflon breaks down at high temperature.

Making Teflon Stick
Invention & Technology Magazine presents an online article on the discovery and development of Teflon®.

Can Teflon make you Sick?
Medical News Today makes available this 2003 article that raises some questions about the safety of Teflon® and the chemicals used in its manufacture.

Ottawa Moving to Limit Non-Stick Chemicals
In June 2006 there was discussion in the federal legislature about banning Teflon and similar substances in Canada. This CTV article gives some background on the discussion.

Wikipedia: Fat
Wikipedia looks into various types of fats (and oils) that can be used to prevent foods from sticking to surfaces while cooking. See the chart on the right of the page, referring to saturated and unsaturated fats.

Does Teflon Cookware Pose Health Hazards? Are Other Cookware Alternatives Safer?
About.com reproduces an article that addresses the question "With the recent hubbub over the chemicals used to make Teflon linked to health problems, what is the safest cookware to use…?" The answer includes information on various cooking surfaces.

Cookware Pros and Cons
Information is presented here on various cookware materials. You can get more details by selecting from the bar on the left.

Evaluation

Descriptor	4	3	2	1
Content of audio-visual presentation	• The group provided **excellent** information about Teflon®, the associated chemicals, and how Teflon is made.	• The group provided **good** information about Teflon®, the associated chemicals, and how Teflon is made, with only minor mistakes or omissions.	• The group provided **some** information about Teflon®, the associated chemicals, and how Teflon is made, with some significant mistakes or omissions.	• The group provided **little** information about Teflon®, the associated chemicals, and how Teflon is made, with major mistakes or omissions.
	• The group provided **excellent** information about the pros and cons of each type of cookware.	• The group provided **good** information about the pros and cons of each type of cookware but their information may have been lacking in detail.	• The group provided **some** information about the pros and cons of each type of cookware, but their information lacked detail or accuracy.	• The group provided **little** information about the pros and cons of each type of cookware, and their information was lacking in detail.
	• The group made a well-reasoned decision.	• The group made an adequately reasoned decision.	• The group came to a decision, but it was poorly supported.	• The group either didn't come to a decision, or did not support their decision.
Overall quality of audio-visual presentation	• Presentation shows evidence of **detailed research**.	• Presentation shows evidence of **adequate research**.	• Presentation shows evidence of **limited research**.	• Presentation shows little evidence of **research**.
	• Presentation was very well **organized**, easy to follow, neat, appealing, and professional looking.	• Presentation was well **organized**, easy to follow, neat, appealing, and professional looking.	• Presentation was somewhat **organized**, easy to follow, neat, appealing, and professional looking.	• Presentation was not **organized**, easy to follow, neat, appealing, or professional looking.
	• Presentation took 10 min $\pm$ 1 min.	• Presentation took 10 min $\pm$ 2 min.	• Presentation took 10 min $\pm$ 4 min.	• Presentation was seriously under or over time.

Learning Outcomes Addressed

30–C1.2k identify and describe significant organic compounds in daily life, demonstrating generalized knowledge of their origins and applications

30–C2.3k define, illustrate and provide examples of monomers, polymers and polymerization in living systems and non-living systems

30–C2.4k relate the reactions described above to major reactions for producing energy and economically important compounds from fossil fuels.

30–C1.2sts explain that science and technology have influenced, and been influenced by, historical development and societal needs

- *explain how, as a result of chemistry and chemical technology, synthetic compounds of great benefit to society such as plastics, medicines, hydrocarbon fuels and pesticides have been produced*.

30–C2.3sts explain how science and technology have both intended and unintended consequences for humans and the environment

- *assess the positive and negative effects of various reactions involving organic compounds, relating these processes to quality of life and potential health and environmental issues*

30–C1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions

- *analyze the contributions and limitations of scientific and technological knowledge to societal decision making in relation to the costs and benefits of society's use of petrochemicals, pharmaceuticals and pesticides*

30–C2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information

- *use library and electronic research tools to collect information*

30–C2.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results

- *use advanced menu features within a word processor to insert tables, graphs, text and graphics when preparing a report on an issue related to society's use of organic chemistry*.

In Summary

Teflon® has been used as a nonstick coating on cookware for over 50 years. Are the concerns about its safety valid? Do the concerns outweigh the benefits? You should now have a better understanding of this issue, and an opinion on the best type of cookware to use.

