

Does Vaping Expose You to Toxic Chemicals?

Teacher Information



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Summary

Does vaping e-cigarettes expose users to toxic (harmful) chemicals, such as those found in traditional cigarettes?

- Conduct simulated urine tests for four toxic chemicals found in cigarette smoke.
- Analyze data from research that tested urine samples from teens for four toxic chemicals.
- Analyze information to determine the danger of respiratory damage associated with vaping the four chemicals.
- Communicate information about e-cigarettes and actions that can be taken to reduce the health risks posed by vaping.

Core Concept

Use of e-cigarettes exposes people to chemical substances known to increase risks of respiratory system damage.

Time Required

- Part 1 through Part 3—40 minutes
- Part 4—40 minutes plus time for internet research

Kit Contains

- Simulated test solutions for four harmful chemicals
- Labeled droppers for four test solutions
- Urine Sample Test Sheet (simulated)
- **Instructions for Urine Sample Testing**
- Information cards (A–D) about four harmful chemicals
- **E-Cigarette Website List**

Teacher Provides

- Paper towels for clean-up
- Optional: Poster paper, art supplies, and sticky notes (4 per poster team) if doing paper posters.

Warning: Choking Hazard

This Science Take-Out kit contains small parts. Do not allow children under the age of seven to have access to any kit components.

Teacher Suggestions

General Suggestions:

- It is recommended that this kit be used as a “conversation starter” to introduce students to the risks of e-cigarette use. The kit is designed to encourage discussions and questions related to exposure to potentially harmful chemicals from use of e-cigarettes (vaping). Encourage students to discuss their opinions, questions, and concerns.
- The purpose of this kit is to make students aware that e-cigarettes have not been shown to be safe and that there is a concern about the short and long-term health effects of vaping.
- This kit is based on the following research publication. Selected data from this paper has been simplified to be appropriate for average middle/high school students.

Adolescent Exposure to Toxic Volatile Organic Chemicals from E-Cigarettes

<https://pediatrics.aappublications.org/content/141/4/e20173557>

- Be aware that your students, their friends, and their family members may use e-cigarettes.
- If you would like to know more about e-cigarettes and vaping before you use this kit with your students, see the **Teacher Background Information** below.

Part 1 Suggestions:

- Ideally, students should work in pairs in order to encourage discussions. Each kit includes one copy of the **Does Vaping Expose You to Toxic Chemicals** student instructions. Make additional copies, as needed, so that each student has a copy of the student instructions.
- Students will need the supplies and **Instructions for the Urine Sample Testing**. Consider reading the scenario on Page 1 aloud to the class. Part 1 is typically completed in 20 minutes. Ask several students to share their answers to questions 3 and 4 with the class.
- There is no “cigarette only” data because the research study that this kit is based on did not include subjects who only smoked cigarettes.

Part 2 Suggestions:

- Students will need the 4 colored cards (**A. Acrolein, B. Acrylamide, C. Crotonaldehyde, D. Acrylonitrile**). Additional colored cards are included with the refill kit packs, so it is OK for students to write on the colored cards. Part 2 is typically completed in 10 minutes.

Part 3 Suggestions:

- Students will need the information from the graphs on the 4 colored cards (**A. Acrolein, B. Acrylamide, C. Crotonaldehyde, D. Acrylonitrile**). Part 3 is typically completed in 10 minutes.

Part 4 Suggestions:

- Divide your class into 4 or 8 teams and assign each team one of the poster topics (Poster 1–4). Teams will need the **E-Cigarette Website List**. If students do their internet research as homework, introducing the assignment should take 5 minutes. If internet research is done in the classroom, allow 20–30 minutes.
- For a “paper poster” option, teams will need poster paper, art supplies/markers, and access to computers for their research. Students could also create “digital posters” using PowerPoint or Flipgrid. Consider limiting the time for making the posters to 20 minutes.
- Some students may get distracted if too many websites are provided. Suggest that these students use the CDC website that is listed first on the list or that different members of a team look at different websites on the list.
- For a “poster gallery walk”, have students put posters on the same topic (1–4) together. Give each group 4 sticky notes. Limit the time teams spend putting sticky notes on the posters to 5 minutes for each topic (1–4).

Teacher Background Information

The claim that “e-cigarettes are safer than cigarettes and can help smokers to quit” ignores important facts:

- Most e-cigarettes contain nicotine. E-cigarette users may become addicted to nicotine.
- E-cigarette liquids contain a variety of potentially harmful substances such as flavorings and other chemicals.
- E-cigarette vapor may include metals such as nickel, tin and lead from the device itself. Inhaling these metals is hazardous.
- It is easy to manufacture “homemade” vaping fluids, so users may not know what chemicals they are vaping. Some homemade vaping fluids contain THC from marijuana.
- Not much is known about the safety of inhaling combinations of different chemical mixtures, and new devices and vaping fluids are being marketed all the time. Regulators are working on policies to make sure e-cigarettes are safe, but the rapid changes in the e-cigarette market have outpaced regulation.

*Source: <https://www.cdc.gov/vitalsigns/youth-tobacco-use/index.html>

The resources below can be used to help develop additional lessons and programs for teens, colleagues, and parents.

- **Centers for Disease Control and Prevention: Electronic Cigarettes**
https://www.cdc.gov/tobacco/basic_information/e-cigarettes/index.htm
- **U.S. Food and Drug Administration: Vaporizers, E-Cigarettes, and other Electronic Nicotine Delivery Systems (ENDS)**
<https://www.fda.gov/tobacco-products/products-ingredients-components/vaporizers-e-cigarettes-and-other-electronic-nicotine-delivery-systems-ends>
- **American Academy of Pediatrics: E-Cigarettes**
<https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Richmond-Center/Pages/Electronic-Nicotine-Delivery-Systems.aspx>
- **Know the Risks: E-Cigarettes and Young People**
<https://e-cigarettes.surgeongeneral.gov/>
- **Public Health Consequences of E-Cigarettes.**
https://www.ncbi.nlm.nih.gov/books/NBK507171/pdf/Bookshelf_NBK507171.pdf
- **American Lung Association: E-Cigarettes**
<https://www.lung.org/stop-smoking/smoking-facts/e-cigarettes-and-lung-health.html>
- **What are the Respiratory Effects of E-Cigarettes?**
<https://www.bmj.com/content/366/bmj.l5275>

Reusing the Kit

Teachers will need to instruct students on how to handle clean-up and return of the re-usable kit materials. For example, teachers might provide the following information for students:

Discard	Return to kit bag
<ul style="list-style-type: none">Urine Sample Test Sheet	<ul style="list-style-type: none">All tubes and droppersInstructions for Urine Sample TestingInformation cards A–D (if students have not written on these)E–Cigarette Website List

Hints:

- To avoid spills or loss of kit materials, you might have students clean up after Part 1.
- It is not necessary to wash the tubes and droppers. Washing may cause the labels to be difficult to read or to fall off. Simply refill the tubes as needed.
- Consider laminating the printed parts of the kits that will be reused.

Refills for **Does Vaping Expose you to Toxic Chemicals?** kits are available at www.sciencetakeout.com. Allow at least 30 minutes to refill 10 kits. The **10 Kit Refill Pack** includes the following materials:

- 10 Sets of 4 information cards
- 10 Urine Sample Test Sheets (simulated)
- 10 mL of Acrolein Test Solution (simulated)
- 10 mL of Acrylamide Test Solution (simulated)
- 10 mL of Crotonaldehyde Test Solution (simulated)
- 10 mL of Acrylonitrile Test Solution (simulated)

Next Generation Science Standards (NGSS) Correlation

Working Towards Performance Expectations MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.		
Science and Engineering Practices Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. Analyze and interpret data to provide evidence for phenomena. Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real world phenomena, examples, or events. Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.	Disciplinary Core Ideas LS1.A: Structure and Function In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. Multicellular organism have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.	Crosscutting Concepts Systems and System Models <ul style="list-style-type: none"> Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. Cause and Effect <ul style="list-style-type: none"> Use cause and effect relationships to predict phenomena in natural or designed systems. Patterns <ul style="list-style-type: none"> Use patterns to identify cause and effect relationships, and use graphs and charts to identify patterns in data.

Kit Contents Quick Guide

A. Acrolein

People are exposed to acrolein mostly from breathing air from cigarette smoke, burning wood, and vehicle exhaust. Acrolein causes burning of the nose and throat and can damage the lung. There is not enough data to determine whether acrolein increases cancer risk in humans.

Sample Type	Acrolein Concentration (µM)
Control	~180
E-Cigarettes	~250
Dust	~400

B. Acrylamide

People are exposed to acrylamide by eating contaminated food and breathing cigarette smoke. Acrylamide affects the nervous system causing muscle weakness, numbness in hands and feet, sweating, untiredness, and dizziness. Acrylamide causes cancer in animals. Scientists and doctors warn that acrylamide is likely to increase cancer risk in humans.

Sample Type	Acrylamide Concentration (µM)
Control	~40
E-Cigarettes	~120
Dust	~200

C. Crotonaldehyde

People are exposed to crotonaldehyde by inhaling cigarette smoke, gasoline and diesel engine exhausts, and smoke from wood burning. Crotonaldehyde can irritate the eyes, nose, throat, and lungs. It can cause coughs, shortness of breath and a build-up of fluid in the lungs. Some people may become sensitive to crotonaldehyde and develop a reaction to crotonaldehyde, even at very low exposure levels. Scientists and doctors warn that crotonaldehyde may increase cancer risk in humans.

Sample Type	Crotonaldehyde Concentration (µM)
Control	~100
E-Cigarettes	~150
Dust	~180

D. Acrylonitrile

People are exposed to acrylonitrile mostly from inhaling cigarette smoke. Acrylonitrile causes nose and throat irritation, tightness in the chest, and difficulty breathing. It burns the skin and causes redness and blisters. In laboratory animals, exposure to acrylonitrile has been linked to decreased fertility, birth defects, and cancers of the brain and mammary glands. Scientists and doctors warn that acrylonitrile may increase cancer risk in humans.

Sample Type	Acrylonitrile Concentration (µM)
Control	~1
E-Cigarettes	~2
Dust	~18

Urine Sample Test Sheet

		A. Acrolein	B. Acrylamide	C. Crotonaldehyde	D. Acrylonitrile
Key	Dial Used both cigarettes and e-cigarettes	Yellow	Yellow	Yellow	Yellow
Andi	E-cigarettes user only e-cigarettes	Yellow	Yellow	Yellow	Yellow
Jovid	Control Never used cigarettes or e-cigarettes	Yellow	Yellow	Yellow	Yellow

E-Cigarette Website List

- Centers for Disease Control and Prevention: Electronic Cigarettes
www.cdc.gov/tobacco/basic_information/e-cigarettes/index.htm
- American Academy of Pediatrics: E-Cigarettes
www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/richmond-center/Pages/Electronic-Nicotine-Delivery-Systems.aspx
- Know the Risks: E-Cigarettes and Young People
<http://cancer.gov/newsroom/stories/2014/07/01/e-cigarettes-young-people>
- American Lung Association: E-Cigarettes
www.lung.org/stop-smoking/smoking-facts/e-cigarettes-and-lung-health.html
- U.S. Food and Drug Administration: Youth Tobacco Prevention Plan
www.fda.gov/tobacco-products/youth-and-tobacco/fda-youth-tobacco-prevention-plan
- U.S. Food and Drug Administration: The Real Cost E-Cigarette Prevention Campaign
www.fda.gov/tobacco-products/public-health-education/real-cost-campaign
- National Academies of Sciences, Engineering, and Medicine: Public Health Consequences of E-Cigarettes
www.nap.edu/resource/2492/21211beipareteconclusionsbyvidence.pdf

Instructions for Urine Sample Testing

The Urine Sample Test Sheet contains dried urine samples from the three items (Key, Andi, and Jovid).

- Use the A. Acrolein Test Solution dropper to apply 1 drop of the A. Acrolein Test Solution to each of the three urine samples in the Acrolein column.
- Use the B. Acrylamide Test Solution dropper to apply 1 drop of the B. Acrylamide Test Solution to each of the three urine samples in the Acrylamide column.
- Use the C. Crotonaldehyde Test Solution dropper to apply 1 drop of the C. Crotonaldehyde Test Solution to each of the three urine samples in the Crotonaldehyde column.
- Use the D. Acrylonitrile Test Solution dropper to apply 1 drop of the D. Acrylonitrile Test Solution to each of the three urine samples in the Acrylonitrile column.
- Interpret the results of the urine sample testing and record the data on the Urine Test Results Data Table on page 2.
 - If the urine sample turns **pink**, write "Yes" because this indicates that the chemical is present in the urine sample.
 - If the urine sample does **not** turn pink, write "No" because this indicates that the chemical is **not** present in the urine sample.

A. Acrolein Test Solution

B. Acrylamide Test Solution

C. Crotonaldehyde Test Solution

D. Acrylonitrile Test Solution

Read these instructions before using Science Take-Out kits

Parental or Adult Supervision Required

This kit should be used only under the supervision of an adult who is committed to ensuring that the safety precautions below, and in the specific laboratory activity, are followed.

Chemicals Used in Science Take-Out Kits

Every effort has been made to reduce the use of hazardous chemicals in Science Take-Out kits. Most kits contain common household chemicals or chemicals that pose little or no risk. Safety Data Sheets (SDS) provide specific safety information regarding the chemical contents of the kits. SDS information for each kit is provided in the accompanying teacher instructions. We encourage students to adopt safe lab practices when performing laboratory activities involving chemicals.

Warning: Choking and Chemical Hazard

Science Take-Out kits contain small parts that could pose a choking hazard and chemicals that could be hazardous if ingested. Do not allow children under the age of seven to have access to any kit components.

No blood or body fluids from humans or animals are used in Science Take-Out kits. Chemical mixtures are substituted as simulations of these substances.

General Safety Precautions

1. Never taste, smell, or ingest any chemicals provided in the kit – they may be hazardous.
2. Chemicals used in Science Take-Out experiments may stain or damage skin, clothing or work surfaces. If spills occur, wash the area immediately and thoroughly.
3. Report any chemical spills or contact with chemicals to your teacher.
4. Work in a clean, uncluttered area. Cover the work area to protect the work surface.
5. Read and follow all instructions carefully.
6. Pay particular attention to following the specific safety precautions provided by your teacher or included in the kit activity instructions.
7. Do not use the contents of this kit for any other purpose beyond those described in the kit instructions.
8. Do not leave experiment parts or kits where they could be used inappropriately by others.
9. Do not eat, drink, or apply make-up or contact lenses while performing experiments.
10. Wash your hands before and after performing experiments.

Does Vaping Expose You to Toxic Chemicals?

Teacher Answer Key

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Part I: Testing for Toxic Chemicals

Cigarette smoking exposes people to many toxic (harmful) chemicals that cause serious health problems, particularly after many years of smoking. Many people believe that vaping (using e-cigarettes) is safe because they think the aerosol (“vapor”) from e-cigarettes does not contain harmful chemicals.



E-Cigarettes (“vapes” or “e-cigs”)

Do e-cigarettes contain toxic (harmful) chemicals such as those found in cigarettes? To answer this question, scientists are conducting research to determine whether vaping exposes teens to four harmful chemicals found in cigarette smoke. Teens who participate in this research take a survey that asks some questions about their use of e-cigarettes. They also donate a urine sample that will be tested to see if they have been exposed to the four harmful chemicals.

The scientists plan to test the urine samples from teens for four harmful chemicals that are known to be found in cigarettes. These four chemicals are acrolein (*a-kro-leen*), acrylamide (*uh-krill-a-mide*), crotonaldehyde (*kro-ton-al-duh-hide*), and acrylonitrile (*a-krill-lo-nai-trial*).

Kay, Andi, and Jovid are three of the 100 teens who are participating in this research study.

- Kay is a “dual user.” She vapes e-cigarettes when she is at home or school, and she also smokes regular cigarettes whenever she gets a chance. She thinks that vaping is a safe way to stop smoking.
- Andi has never smoked regular cigarettes, but she enjoys vaping flavored e-cigarettes when she is relaxing with friends. She thinks vaping is safe because it’s only “vapor”.
- Jovid has never smoked or vaped. He thinks that e-cigarettes contain harmful chemicals and that they may not be as safe as his friends think.

1. Do you think vaping e-cigarettes exposes people to harmful chemicals? Explain why or why not.

2. You will help the scientists by testing dried urine samples from Kay, Andi, and Jovid for four chemicals typically found in cigarette smoke. Use the materials and instructions in the bag labeled **Urine Testing** to test their urine samples. Record the results of the urine tests in the data table below.

Urine Test Results Data Table

		Harmful Chemicals Present in Urine			
		A. Acrolein (a-kro-leen) Yes or No	B. Acrylamide (uh-krill-a-mide) Yes or No	C. Crotonaldehyde (kro-ton-al-duh-hide) Yes or No	D. Acrylonitrile (a-krill-lo-nai-trial) Yes or No
Kay	<u>Dual</u> Used both cigarettes and e-cigarettes				
Andi	<u>E-cigarettes</u> Used only e-cigarettes				
Jovid	<u>Control</u> Never used cigarettes or e-cigarettes				

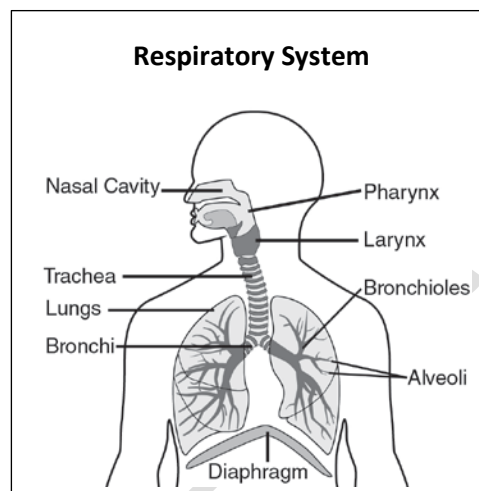
3. Based on the information in the data table above, do e-cigarettes expose users to harmful chemicals such as those found in cigarettes? Support your answer with evidence from the data table.
4. What kinds of evidence might provide additional support for the claim that e-cigarettes expose users to harmful chemicals such as those found in cigarettes?

Part 2: Are the Chemicals Really Harmful?

Are the chemicals found in the urine samples that you tested really harmful? Do these chemicals cause damage to the respiratory system?

1. Use the information at the top of the four colored cards in your kit to complete the chart below.

Circle **Yes**, **Possibly**, or **No** to indicate if the information on the cards provides evidence that the chemical is harmful because it damages the human respiratory system.



	Damages the Human Respiratory System?		
A. Acrolein	Yes	Maybe	No
B. Acrylamide	Yes	Maybe	No
C. Crotonaldehyde	Yes	Maybe	No
D. Acrylonitrile	Yes	Maybe	No

2. Are the chemicals found in the urine samples harmful? Support your answer with information from the four colored cards and the data table above.

Many older people who started smoking cigarettes when they were young did not think that smoking was harmful to their health. Some health problems (such as cancer and lung damage) that were caused by harmful chemicals in cigarettes took many years to develop. It took decades and many research studies before the Surgeon General's Warning labels (such as the one below) were required on packs of cigarettes.

SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy.

Based your answers to questions 3 and 4 on the information in the text box above.

3. Do you think that people who vape are likely to develop health problems as a result of their long-term use of e-cigarettes? Explain why or why not.
4. Do you think that warning labels should be required on e-cigarettes? Explain why or why not.

Part 3: Evidence from the Research

The research that Kay, Andi, and Jovid participated in included 100 teen participants. The average age of the participants was 16.4 years. The participants in this research were divided into three groups:

Controls <i>Did not use cigarettes or e-cigarettes</i>	E-Cigarettes Only <i>Used e-cigarettes</i>	Dual Users <i>Used cigarettes and e-cigarettes</i>
20 teens	67 teens	13 teens

Urine samples from all 100 participants were tested to determine the concentration of the four chemicals (acrolein, acrylamide, acrylonitrile, and crotonaldehyde) in each of the urine samples.

The results of the tests are shown in the graphs on the four colored cards in your kit. (Note: The concentration is in ng/ml of urine = nanograms of chemical/milliliter of urine)

Base your answers to questions 1 through 8 on the information and graphs on the four colored cards.

1. Which harmful chemical is present in the highest concentration in e-cigarette only users?

- What is the approximate concentration of this chemical? _____ ng/ml.

2. Which chemical is present in the lowest concentration in e-cigarette users?

- Can you be sure that the low concentration of this chemical is safe? Explain why or why not.

3. Which harmful chemicals are found in both the controls and in the e-cigarette users?

- Are the concentrations of these harmful chemicals in e-cigarette users lower, higher, or the same as in the controls?

4. Explain how people in the control group (those who do not use e-cigarettes or cigarettes) might have these chemicals in their urine.
5. Does the presence of these chemicals in the controls mean e-cigarette users should not be concerned about exposure to these chemicals? Explain why or why not.
6. The median urine concentration for crotonaldehyde (C) in the entire control group is 100 ng/ml. The tests you conducted showed that Jovid (a member of the control group) does not have any crotonaldehyde in his urine. Explain how this is possible.

The "median" is the "middle" value in the list of numbers. Half of the data will be above the median value and half of the data will be below the median value.

Claim: People who use e-cigarettes are exposed to harmful chemicals such as those found in traditional cigarettes.

7. What evidence from the graphs on the four colored cards supports this claim?
8. Justify why you included this evidence as support for the claim. Explain why the evidence that you selected is important for supporting the claim.

Some people claim that e-cigarette use is safe because their friends who vape are healthy. Others warn that it took decades to convince people that long-term cigarette smoking increases a person's risk for serious health problems such as cancer, lung disease, heart disease and strokes.

9. What kinds of evidence might be useful for convincing people that long-term use of e-cigarettes increases their risk for health problems in the future?

Part 4: Communicating with E-Cigarette Infographics Posters

An **infographic** is a collection of imagery, charts, and minimal text that gives an easy-to-understand overview of a topic. Infographics use striking, engaging visuals to communicate information quickly and clearly.

1. Your team has been given one of the infographic poster assignments listed below. Work with your team to complete your infographic poster assignment. *Note: The **E-Cigarettes Website List** in your kit provides some reliable information sources for your infographic.*

Infographic Poster Assignments

<p style="text-align: center;">Poster 1</p> <p>Vaping (using e-cigarettes) exposes teens and young adults to many ingredients that may have long-term, harmful effects on their health as they get older. Create an infographic poster that shows 8 harmful substances found in e-cigarettes and how these substances may affect the health of e-cigarette users as they get older.</p>	<p style="text-align: center;">Poster 2</p> <p>There are actions that people can take to reduce the use of e-cigarettes (vaping) by teens and young adults. Create an infographic poster that includes 4 actions <u>you</u> could take and 4 actions that groups (communities, organizations, or governments) could take to reduce the use of e-cigarettes.</p>
<p style="text-align: center;">Poster 3</p> <p>Companies use a variety of marketing strategies to encourage teens and young adults to vape (use e-cigarettes). Create an infographic poster that includes 6 ways that companies target teens and young adults in advertisements for e-cigarettes.</p>	<p style="text-align: center;">Poster 4</p> <p>Once teens and young adults begin vaping (using e-cigarettes), it is difficult to quit. Create an infographic poster that includes 4 reasons why quitting e-cigarettes might be difficult and 4 actions that e-cigarette users could take to quit.</p>

2. Post your infographic poster as directed by your teacher. With your team, take a “poster gallery walk” by visiting the infographic posters created by other groups. At each poster, your team should read the assignment for the poster (Infographic Poster Assignments 1–4 above) and then add four sticky notes to the poster:
 - The most interesting thing you learned from the infographic poster
 - An idea to add to the infographic poster
 - A question you have related to the infographic poster
 - A suggestion for improving the infographic

Section 1 Chemical Product and Company Information

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

Product	Buffer Solution pH10
Synonyms	"Acrolein Test Solution" (simulated), "Acrylamide Test Solution" (simulated), "Crotonaldehyde Test Solution" (simulated), and "Acrylonitrile Test Solution" (simulated)

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING
Pictograms: None required
Target organs: None known

GHS Classification:
Skin irritation (Category 3)
Eye irritation (Category 2B)

GHS Label information: Hazard statement(s):
H316: Causes mild skin irritation.
H320: Causes eye irritation.

Precautionary statement(s):

P264: Wash hands thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332+P313: If skin irritation occurs: Get medical attention.

P337+P313: If eye irritation persists: Get medical attention.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.77%	231-791-2
Potassium chloride	7447-40-7	0.10%	231-211-8
Boric acid	10043-35-3	0.08%	233-139-2
Sodium hydroxide	1310-73-2	0.05%	215-185-5

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances.

Section 8 Exposure controls / Personal Protection

Exposure Limits:	Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
	Potassium chloride	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Clear, colorless liquid. Odor: No odor. Odor threshold: Data not available. pH: 10.0 Melting/Freezing point: Approx. 0°C (32°F) (water) Boiling point: Approx. 100°C (212°F) (water) Flash point: Data not available	Evaporation rate (Water = 1): <1 Flammability (solid/gas): Data not available. Explosion limits: Lower/Upper: Data not available Vapor pressure (mm Hg): 14 (water) Vapor density (Air = 1): 0.7 (water) Relative density (Specific gravity): Approx. 1.0 (water) Solubility(ies): Complete in water.	Partition coefficient: Data not available Auto-ignition temp.: Data not available Decomposition temp.: Data not available Viscosity: Data not available. Molecular formula: Mixture Molecular weight: Mixture
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Section 10 Stability and Reactivity

Chemical stability: Stable

Hazardous polymerization: Will not occur.

Conditions to avoid: Excessive temperatures which cause evaporation.

Incompatibilities with other materials: Acids, alkalies, and air will change the buffer's ability.

Hazardous decomposition products: Boron oxide and chlorine gas.

Section 11 Toxicological Information

Acute toxicity: Data not available

Serious eye damage/irritation: Data not available

Germ cell mutagenicity: Data not available

Skin corrosion/irritation: Data not available

Respiratory or skin sensitization: Data not available

Carcinogenicity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available

STOT-single exposure: Data not available

Aspiration hazard: Data not available

STOT-repeated exposure: Data not available

Potential health effects:

Inhalation: May be harmful if inhaled.

Ingestion: May be harmful if swallowed.

Skin: May cause mild irritation.

Eyes: May cause mild irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.

Additional information: RTECS #: Data not available

Section 12 Ecological Information

Toxicity to fish: No data available

Toxicity to daphnia and other aquatic invertebrates: No data available

Toxicity to algae: No data available

Persistence and degradability: No data available

Bioaccumulative potential: No data available

Mobility in soil: No data available

PBT and vPvB assessment: No data available

Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable

Shipping name: Not Regulated

Hazard class: Not applicable

Packing group: Not applicable

Reportable Quantity: No

Marine pollutant: No

Exceptions: Not applicable

2012 ERG Guide # Not applicable

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Potassium Chloride	Listed	Not Listed	Not Listed	Listed	Not Listed	Uncontrolled Product
Sodium hydroxide	Listed	1,000 lbs (454 kg)	D002	Listed	Not Listed	E

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.

NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.