

Lung Disease: Genes and Your Environment

Teacher Information

science
take-out®

just add students™

Summary

Follow the case of a mother with chronic obstructive pulmonary disease (COPD). Conduct simulated genetic tests to determine if she and her son have Alpha-1 deficiency, a genetic predisposition for COPD. Model the correlation between COPD and Alpha-1 deficiency. Explore environmental and occupational factors that increase the risk for COPD.

Core Concepts

- Chronic obstructive pulmonary disease (COPD) may result from interactions between a person's genes and their environment.
- Genetic testing can make people aware that they should avoid exposure to environmental risk factors for COPD.
- Environmental risk factors for lung disease include cigarette smoke, household products, substances in the workplace, and outdoor air pollution.

Time Required

Two 40-minute class periods

Kit contains

- 4 simulated serum samples – Abby, Kyle, normal individual, and Alpha-1 individual
- 4 labeled droppers
- Alpha-1 Test Sheets for Abby and Kyle
- Sheet with 200 O's and X's representing people with or without COPD
- Transparency sheet with red dots to represent results of Z gene probe
- Information sheet – *What is COPD?*
- Information sheet – *Staying Healthy: Reducing Environmental Risk Factors for COPD*

Teacher Provides

- Safety goggles
- Paper towels for clean up
- If your students are working in teams, consider making extra copies of the information sheets.

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.

Background Information and Additional Resources

Alpha-1 Antitrypsin (AAT) deficiency is hereditary, and increases susceptibility for developing COPD. Data on the worldwide incidence of the AAT deficiency gene suggests that it is among the most common genes for hereditary diseases in humans. For example, one research study estimated that 1 in 4,000 individuals are Alpha-1 deficient and do not realize it. Another study estimated that 1 in 11.3 individuals in the United States are either Alpha-1 deficient or Alpha-1 carriers.

Alpha-1 deficiency and Alpha-1 carriers is a rich inquiry topic that integrates environmental health, classical genetics, molecular genetics, biochemistry, population genetics, human physiology, ethics, and biotechnology.

Suggested “starter” resources include:

- Alpha-1 Foundation website <http://www.alpha1.org/>
- **Environmental Occupational and Genetic Risk Factors for Alpha-1 Antitrypsin Deficiency** <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241718/pdf/ehp0111-001749.pdf>
- **Alpha-1 antitrypsin deficiency is not a rare disease but a disease that is rarely diagnosed** <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241756/>

Reusing kits

Kits may be refilled and reused. Allow approximately 15–30 minutes for refilling 10 student kits. Teachers will need to instruct students on how to handle clean-up and return of the reusable kit materials. For example, teachers might provide the following information for students:

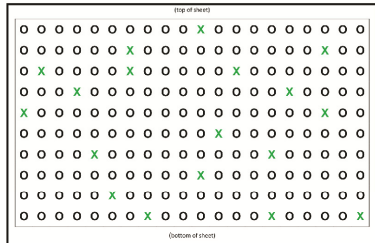
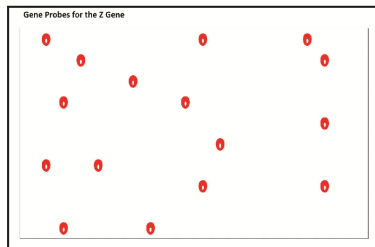
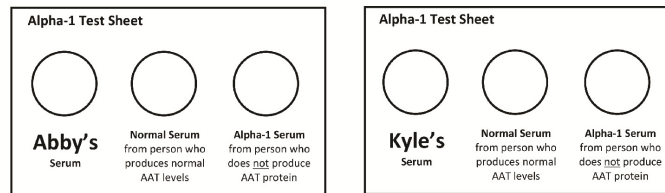
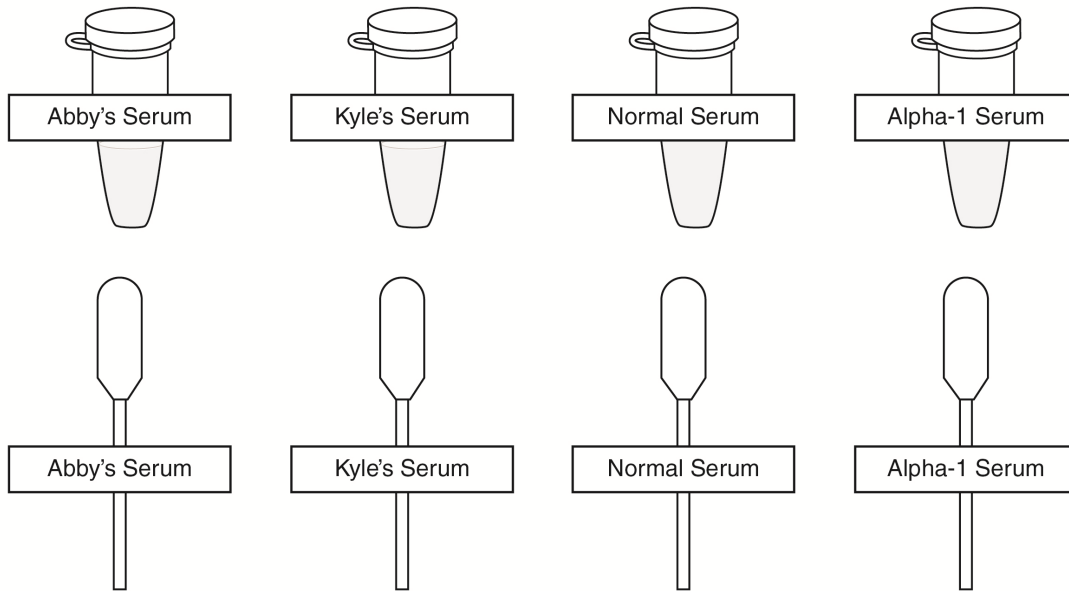
Discard	Return to kit
Alpha-1 Test Sheets for Abby and Kyle	- All droppers - All tubes <i>What is COPD?</i> information sheet <i>Staying Healthy</i> information sheet

Note: It is not necessary to rinse or wash the droppers after use. Because they are labeled, there is little chance for contamination. Because the droppers are labeled, there is little chance for contamination. Washing the droppers may make the labels difficult to read. Simply ask students to squirt out any extra liquid from the droppers.

Refills for *Lung Disease: Genes and Your Environment* kits are available at www.sciencetakeout.com. The **10 Kit Refill Pack** includes the following materials:

- Instructions and Quick Guide for refilling kits
- 10 Alpha-1 Test Sheets for Abby
- 10 Alpha-1 Test Sheets for Kyle
- 5 mL Abby's Serum
- 5 mL Kyle's Serum
- 10 mL Normal Serum
- 10 mL Alpha-1 Serum
- 4 graduated transfer pipets (for refilling the tubes)

Kit Contents Quick Guide



Staying Healthy: Reducing Environmental Risk Factors for COPD

There are many things in the environment that can increase people's risk of developing chronic obstructive pulmonary disease (COPD).

- Alpha-1 deficient individuals and Alpha-1 carriers are more susceptible to (likely to be harmed by) the environmental risk factors that increase their risk for developing COPD.
- Normal individuals may still develop COPD, particularly if they are exposed to environmental risk factors such as tobacco smoke, household chemicals, workplace chemicals, and air pollution.

Luckily, many of the environmental risk factors for COPD and other lung diseases are entirely or partially controllable. That means all people can take actions to prevent COPD or slow its progression. These same preventive actions can also help to reduce asthma attacks and other respiratory problems.

Smoking:

Smoking is an environmental risk factor associated with COPD, cancer, stroke, and heart disease. Cigarette smoke irritates the airways and lungs and triggers inflammation and the release of enzymes that are destructive to lung tissue. Smoking a single cigarette can destroy all the protective Alpha-1 Antitrypsin in the lungs. Even exposure to second hand smoke damages the lungs. The most important thing that you can do to prevent COPD is to eliminate exposure to all forms of tobacco smoke. Cigarette smoke damages lung and increases the risk for COPD for all people. For smokers who are not Alpha-1 deficient or Alpha-1 carriers, COPD symptoms tend to develop during their 30s and 40s. For Alpha-1 deficient individuals or Alpha-1 carriers, COPD symptoms may develop as early as their 20s.

Household Hazards:

Numerous substances in the home have been identified as risk factors for lung damage. Fumes from the kitchen, workshop, garage, unvented heaters, and formaldehyde in building products, fabrics, and carpet can lead to lung problems, particularly from prolonged exposure. Aerosol products such as deodorants, hair sprays, perfumes, and air fresheners may also be problems. Airborne particles from powders, dust, and dirt can also lead to lung irritation. Household products such as aerosol based cleaning products, oven cleaners, bleach, spray paint, and bug sprays may pose a threat if their fumes are inhaled. Moist areas in bathrooms, kitchens, basements and garages may support the growth of mold and mildew that irritate lung tissue.

Workplace Hazards:

A variety of airborne substances in the workplace are health hazards. Exposure to these substances can pose serious health risks for healthy individuals as well as for Alpha-1 deficient individuals and Alpha-1 carriers. Employees need to be knowledgeable about the potentially harmful substances they will come in contact with in the workplace. Employees must have a Safety Data Sheet (SDS) on file for all of the potentially harmful substances in the workplace. The SDS provides recommendations for avoiding, reducing, or eliminating exposure and actions that should be taken in the event of exposure. For example, properly fitted respirator masks can be used to reduce the risk of exposure associated with smoke, dust, fumes, mist or particles. Employees are responsible for reporting an unsafe work environment to the Occupational Safety and Health Administration (OSHA). This can become a tricky issue when certain environmental hazards pose risks for susceptible individuals, such as Alpha-1 deficient individuals and Alpha-1 carriers, but not for other workers.

Air Pollution:

Poor outdoor air quality and air pollution affects everyone, but individuals with respiratory problems are at greater risk. Exhaust from vehicles, air pollution, smog, ozone, chemicals, fertilizers, pesticides, bacteria, mold spores, and pollen contribute to poor air quality. The Environmental Protection Agency (EPA) has developed the Air Quality Index (AQI) with information about how clean or polluted the air is and what associated health effects might be a problem. The AQI focuses on health effects that you may experience within a few hours or days after breathing polluted air. The AQI considers five major air pollutants: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, the EPA has established national air quality standards to protect public health.

What is COPD?

Chronic Obstructive Pulmonary Disease (COPD) includes two types of breathing problems—emphysema and chronic bronchitis.

Chronic Obstructive Pulmonary Disease (COPD)

Chronic Bronchitis
Healthy: Inflammation & excess mucus

Emphysema
Healthy: Air sacs membranes break down

Emphysema damages the air sacs in the lungs. This causes reduced ability to absorb oxygen and release carbon dioxide.

Chronic bronchitis irritates and inflames the lining of airways resulting in thick mucus that blocks airways and makes it hard to breathe.

Most people who have COPD have both emphysema and chronic bronchitis.

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.

Safety Goggles and Gloves Strongly Recommended

We encourage students to adopt safe lab practices, and wear safety goggles and gloves when performing laboratory activities involving chemicals. Safety goggles and gloves are not provided in Science Take-Out kits. They may be purchased from a local hardware store or pharmacy.

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. 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.

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.

General Safety Precautions

1. Work in a clean, uncluttered area. Cover the work area to protect the work surface.
2. Read and follow all instructions carefully.
3. Pay particular attention to following the specific safety precautions included in the kit activity instructions.
4. Goggles and gloves should be worn while performing experiments using chemicals.
5. Do not use the contents of this kit for any other purpose beyond those described in the kit instructions.
6. Do not leave experiment parts or kits where they could be used inappropriately by others.
7. Never taste or ingest any chemicals provided in the kit – they may be toxic.
8. Do not eat, drink, or apply make-up or contact lenses while performing experiments.
9. Wash your hands before and after performing experiments.
10. 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.
11. At the end of the experiment, return ALL kit components to the kit plastic bag. Dispose of the plastic bag and contents in your regular household trash.

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.

Lung Disease: Genes and the Environment



just add students™

Part I: Abby's Story

Abby was experiencing a persistent cough, sinus problems, shortness of breath, and fatigue even after mild exercise. Her family doctor suggested that she see a pulmonologist (a doctor who specializes in treating respiratory problems). The pulmonologist discussed Abby's symptoms and he then conducted lung function tests. He told Abby that her lung function tests clearly showed that she had **COPD** (Chronic Obstructive Pulmonary disease).

COPD includes two breathing problems – emphysema and chronic bronchitis. Most cases of COPD are caused by exposure to inhaling pollutants such as smoke, fumes, chemicals, and dust. Genetics can also play a role in an individual's development of COPD.

Use the **What is COPD?** information sheet in your lab kit to answer questions 1 and 2.

1. How does emphysema lead to reduced ability to absorb oxygen and release carbon dioxide?

2. How does chronic bronchitis make it difficult to breathe?

The pulmonologist was concerned because Abby was only 40 years old, and symptoms of COPD usually do not show up until people are in their 60s or 70s. When he asked Abby questions about ways that she could have been exposed to inhaled pollutants, she revealed that she smoked about one pack of cigarettes per day. Abby also said that she worked for a house remodeling company and she was exposed to fumes, chemicals and dust at her workplace.

3. List at least 4 things in Abby's environment that could have increased her risk of developing COPD.

Part 2: Genes and COPD

The pulmonologist suspected that Abby may also have an inherited susceptibility for COPD. The most commonly known inherited risk factor for COPD are defective genes that cause **Alpha-1 Antitrypsin Deficiency** (also called **Alpha-1 deficiency** or **Alpha-1**).

Alpha-1 Antitrypsin (AAT) is a protective protein that prevents enzymes released by white blood cells from damaging lung tissue.

- People who do not have Alpha-1 deficiency have two normal genes (**MM**) that produce the protective AAT protein.
- People with Alpha-1 deficiency have two defective genes (**ZZ**) that do not produce protective AAT protein. These people are more likely to develop COPD because they do not make the AAT protein needed to prevent their lungs from being damaged by enzymes released by white blood cells.

Normal:

MM genes → AAT protein → prevents enzymes from breaking down lung tissue

Alpha-1 deficiency:

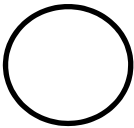
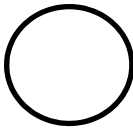
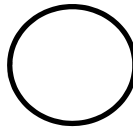
ZZ genes → no AAT protein → enzymes break down lung tissue

4. What does the protective protein AAT (Alpha-1 Antitrypsin) do?

5. How is the AAT level in a person with Alpha-1 deficiency different from a normal person who does not have Alpha-1 deficiency?

6. Why would people with Alpha-1 be more likely to develop COPD?

7. The pulmonologist ordered a simple blood test to determine if Abby had Alpha-1 Antitrypsin deficiency. Use the test sheet for **Abby's** serum to determine if she has Alpha-1 Antitrypsin deficiency.
 - a) The circles on **Abby's** Alpha-1 Test Sheet in your kit have been spotted with antibodies that turn pink when they attach to the protective AAT protein.
 - b) Add one drop of Abby's blood serum to the first circle.
 - c) Add one drop of normal serum (from a person who has normal AAT levels) to the second circle.
 - d) Add one drop of Alpha-1 serum (from an Alpha-1 person who does not make the protective AAT protein) to the third circle.
 - e) When antibodies on the test paper attach to the protective AAT protein, a pink color results. No color indicates that no AAT is produced.
 - f) Record the results of the Alpha-1 tests on the diagram below.

Alpha-1 Test Sheet		
		
Abby's Serum	Normal Serum from person who produces normal AAT levels	Alpha-1 Serum from person who does <u>not</u> produce AAT protein

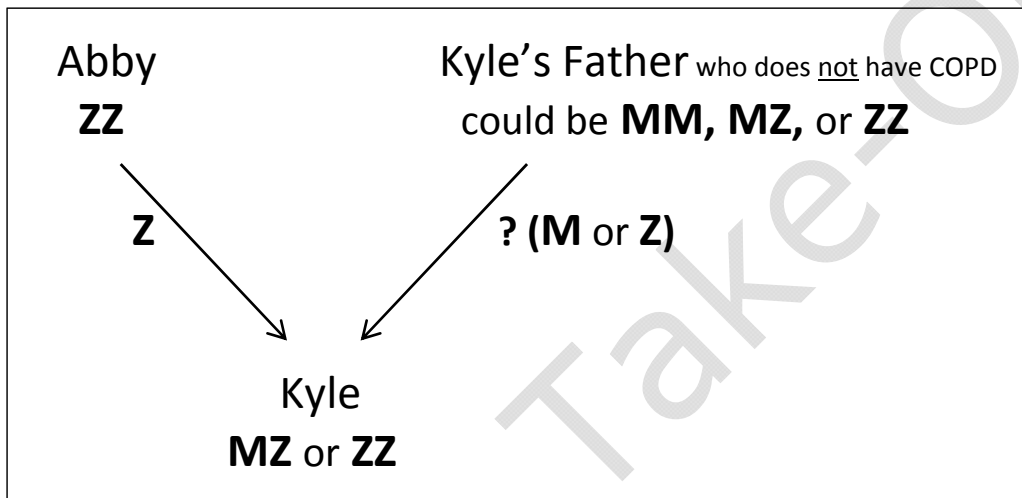
8. Does Abby have Alpha-1 deficiency? Explain how you can tell.

9. COPD is a progressive disease. That means that Abby's lung function will gradually get worse with time—particularly if she continues to be exposed to environmental factors that cause COPD. List at least 4 actions Abby should take to reduce the rate at which her COPD progresses.

Part 3: Testing Kyle

The doctor explained that Abby had two **ZZ** genes that caused her Alpha-1 Antitrypsin deficiency. That meant that Abby's son Kyle would inherit one defective **Z** gene from her. The doctor also explained that a normal M gene produces protective AAT protein.

The diagram below shows the gene combinations that Kyle could have inherited from his mother and his father (who does not have COPD).



Use the information and diagram above to answer questions 1 and 2.

1. Circle the gene combination that would result in:

- normal AAT levels. **ZZ** **MZ** **MM**
- no AAT production. **ZZ** **MZ** **MM**
- low level of AAT production. **ZZ** **MZ** **MM**

2. Circle the gene combinations that Kyle could have. **ZZ** **MZ** **MM**

The doctor strongly recommended that Abby's son Kyle be tested to see if he has Alpha-1 Antitrypsin deficiency.

3. Use the test sheet with **Kyle's** serum to determine if he has Alpha-1 deficiency.
 - a) The circles on **Kyle's** Alpha-1 Test Sheet have been spotted with antibodies that turn pink when they attach to the protective AAT protein.
 - b) Add one drop of Kyle's blood serum to the first circle.
 - c) Add one drop of normal serum (from a person who has normal AAT levels) to the second circle.
 - d) Add one drop of Alpha-1 serum (from an Alpha-1 person who does not make the protective AAT protein) to the third circle.
 - e) When antibodies on the test paper attach to the protective AAT protein, a pink color results. A dark pink color indicates normal AAT protein levels. A lighter pink color indicates low AAT levels. No color indicates that no AAT is produced.
4. Which does Kyle's test result show? (circle one answer)
 - Dark pink indicating normal AAT level
 - Light pink indicating a lower than normal AAT level
 - No color indicating no AAT

5. How might you explain why Kyle produces higher amounts of AAT protein than his mother but lower amount of AAT protein than a normal person? *Hints: What gene (an **M** gene or a **Z** gene) did he inherit from his father? What is his genotype (**MM**, **MZ**, or **ZZ**)?*

The doctor explained that Kyle is an Alpha-1 carrier. He has one normal gene (**M**) for making the AAT protein and one mutant gene (**Z**) that does not make AAT protein.

6. How is an Alpha-1 carrier different from a normal person?

7. How is an Alpha-1 carrier different from a person with Alpha-1 deficiency?

8. Why do people like Kyle who are Alpha-1 carriers (the **MZ** genotype) have an increased risk for developing respiratory problems such as COPD?

Once Kyle discovered that being an Alpha-1 carrier makes people more susceptible to COPD, he wanted to take action to protect his lungs. Kyle's pulmonologist gave him an information sheet to help him understand the actions he could take to reduce his risks for COPD and other respiratory problems.

Kyle's doctor also explained that people who do not have Alpha-1 deficiency or are not Alpha-1 carriers may still develop COPD damage if they are exposed to environmental risk factors. That means all people should take actions to prevent COPD. These same preventative actions can also help to reduce asthma attacks and other respiratory problems.

Base your answers to questions 9 through 11 on the information in the ***Staying Healthy: Reducing Environmental Risk Factors for COPD*** in your lab kit.

9. Make a list of at least five actions that Kyle and other people could take AT HOME to prevent exposure to lung damaging environmental factors.

- _____
- _____
- _____
- _____
- _____

10. Make a list of at least three actions that Kyle and other people could take AT WORK to prevent exposure to lung damaging environmental factors.

- _____
- _____
- _____

11. Make a list of at least five actions that Kyle and other people could take WHEN OUTDOORS to prevent exposure to lung damaging environmental factors.

- _____
- _____
- _____
- _____
- _____

Part 4: Not a Rare Disease, but Rarely Diagnosed

When Alpha-1 Antitrypsin (AAT) deficiency was first discovered in 1963, it was thought that it was a very rare disease only found in people with Northern European ancestry. However, research has now shown that Alpha-1 deficiency affects individuals in all racial subgroups worldwide.

In addition, research has shown that Alpha-1 deficiency is not a rare condition when compared to many other genetic disorders. In fact, it may be ranked in the top five most common single gene hereditary disorders in the world. Alpha-1 deficiency is underdiagnosed because its effects usually appear later in life and it is often misdiagnosed as an infectious disease, asthma, or allergies.

- Sickle Cell Anemia: affects **1 in 2,000** people
- Cystic Fibrosis: affects **1 in 2,500** people
- Alpha-1 Antitrypsin deficiency: affects **1 in 5,000** people
- PKU (phenylketonuria): affects **1 in 10,000** people

The effects of sickle cell anemia, cystic fibrosis and PKU usually appear in childhood.

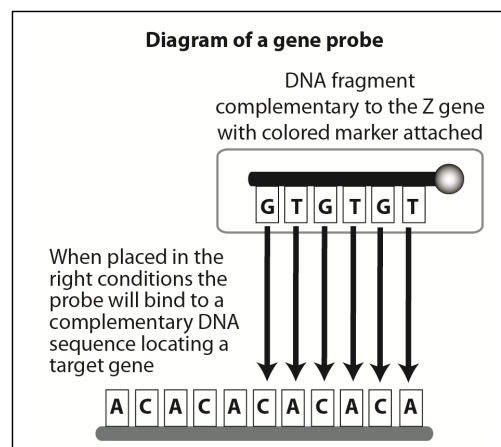
1. List two reasons why Alpha-1 Antitrypsin deficiency is rarely diagnosed even though it is a relatively common genetic disease.

- _____
- _____

On the following page, you will simulate an experiment with 200 people to determine how many of them have one or two **Z** genes that put them at increased risk for developing COPD.

Researchers conducted gene probe tests to determine which of the 200 people had at least one **Z** gene. A gene probe is a DNA fragment with a colored marker attached to it. If a person has a **Z** gene, the gene probe will attach to it and produce a red spot.

You will simulate the research that used a gene probe to determine which of the 200 people have one or two **Z** genes that put them at increased risk for developing COPD.



2. Your lab kit contains a sheet of paper with 200 O's and X's on it. Each O or X has been dotted with blood serum from a different person.
 - The green X's represent 60 year-old adults with COPD.
 - The black O's represent 60 year-old adults who do not have COPD.
3. Place the clear plastic sheet with red spots labelled "Gene Probes for the Z Gene" on top of the sheet of X's and O's. Be sure to line up the rectangle around the X's and O's with the rectangle around the red spots.

Red spots indicate that the gene probe has combined with **Z** genes. People who have one or two **Z** genes will be covered with a red spot.

4. Complete the following data table for the 200 people in the experiment.

Number of the 200 people who...	Count the...	Number
Have COPD	Green X's	
Do not have COPD	O's	
Have the Z gene	Red spots	
Do not have the Z gene	No red spots	
Have COPD but do <u>not</u> have the Z gene	Green X's with no red spot	
Have the Z gene and do <u>not</u> have COPD	O's with red spots	
Have the Z gene and have COPD	X's with red spots	

Base your answers to questions 5 through 10 on the information in the data table on the previous page.

5. Is it possible to have COPD and not have a **Z** gene? Support your answer with information from the gene probe tests.

6. What might cause COPD in people who do not have a **Z** gene?

7. Calculate the probability that a person who does not have the **Z** gene will develop COPD.

$$\frac{\text{\# who have COPD but do not have Z gene}}{\text{\# who do not have Z gene}} = \quad =$$

8. Is it possible to have a **Z** gene and not have COPD? Support your answer with information from the data table.

9. Calculate the probability that a person who has the **Z** gene will develop COPD.

$$\frac{\text{\# who have COPD and who have Z gene}}{\text{\# who have Z gene}} = \quad =$$

10. Based on the data collected from the 200 people in the experiment, are people who have the **Z** gene more susceptible to developing COPD? Support your answer with information from the data table on the previous page or your calculations.

All newborns have screening tests designed to identify babies who may be at an increased risk of certain conditions such as PKU (phenylketonuria) and cystic fibrosis. This testing is expensive but worthwhile because it allows a condition to be identified and treated before problems occur. Currently no states in the US include testing for Alpha-1 in their newborn screening programs. Some people support newborn testing for Alpha-1 because it might enable people to avoid exposure to environmental factors for COPD. Other people are concerned about the cost of testing for Alpha-1 and about the invasion of their privacy that may result in prejudices or interfere with future employment.

11. Explain one reason why some people support testing newborns for Alpha-1.

12. Explain one reason why some people do not support testing newborns for Alpha-1.

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	"Normal Serum" (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	99.08%	231-791-2
Potassium chloride	7447-40-7	0.40%	231-211-8
Boric acid	10043-35-3	0.33%	233-139-2
Sodium hydroxide	1310-73-2	0.19%	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
---	---	--

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, alkalis, 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.

SAFETY DATA SHEET

GENERAL STORAGE CODE GREEN

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 pH9
Synonyms	"Kyle's Serum" (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 minor 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	99.18%	231-791-2
Potassium chloride	7447-40-7	0.40%	231-211-8
Boric acid	10043-35-3	0.33%	233-139-2
Sodium hydroxide	1310-73-2	0.09%	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: 9.0 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
--	---	--

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, alkalis, 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.

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	Water
Synonyms	"Abby's Serum" (simulated), "Alpha 1 Serum" (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: Not Classified

Pictograms: None required

Target organs: None known

GHS Classification: Not classified

GHS Label information: Hazard statement(s): Not classified

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	7732-18-15	100%	231-791-2

Section 4 First Aid Measures

INGESTION:

INHALATION:

EYE CONTACT:

SKIN ABSORPTION:

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: Data not available.

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.

Section 7 Handling and Storage

Precautions for Safe Handling: Data not available.

Conditions for Safe Storage: Data not available.

Section 8 Exposure controls / Personal Protection

Exposure Limits:	Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
	N/A	N/A	N/A	N/A

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: Data not available Melting/Freezing point: Data not available Boiling point: 100°C @760mmHg (212°F) Flash point: Not combustible	Evaporation rate (Water = 1): 1 Flammability (solid/gas): Data not available. Explosion limits: Lower/Upper: Data not available Vapor pressure (mm Hg): Data not available Vapor density (Air = 1): Data not available Relative density (Specific gravity): 1.000 Solubility(ies): N/A.	Partition coefficient: Data not available Auto-ignition temp.: Data not available Decomposition temp.: Data not available Viscosity: Data not available. Molecular formula: H ₂ O Molecular weight: 18.02
---	---	---

Section 10 Stability and Reactivity

Chemical stability: Stable **Hazardous polymerization:** Will not occur.

Conditions to avoid: Data not available.

Incompatibilities with other materials: Data not available.

Hazardous decomposition products: Data not available.

Section 11 Toxicological Information

Acute toxicity: Oral-rat LD50: >90 mL/kg 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 Aspiration hazard: Data not available	STOT-single exposure: Data not available STOT-repeated exposure: Data not available
Potential health effects: Data not available 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 #:	

Section 12 Ecological Information

Toxicity to fish: Data not available Toxicity to daphnia and other aquatic invertebrates: Data not available Toxicity to algae: Data not available	Bioaccumulative potential: No data available PBT and vPvB assessment: No data available
Persistence and degradability: No data available Mobility in soil: 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 Hazard class: Not applicable Exceptions: Not applicable	Shipping name: Not Regulated Packing group: Not applicable 2012 ERG Guide # Not applicable	Reportable Quantity: No	Marine pollutant: No
---	---	--------------------------------	-----------------------------

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
Water	Listed	Not Listed	Not listed	Listed	Not listed	Uncontrolled product

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.

Section 1 L'information de produit chimique et de compagnie

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

**CHEMTREC 24 Numéros De Téléphone
De Secours D'Heure (800) 424-9300**
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	Solution de tampon pH10
Synonymes	"Normal Serum" (simulated)

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: AVERTISSEMENT

Pictogrammes: Aucune requise

Les organes cibles: Aucun connu.

Classification par le GHS:

Skin irritation (Category 3)

Eye irritation (Category 2B)

Renseignements sur l'étiquette GHS: Mention de danger(s):

H316: Provoque une légère irritation cutanée.

H320: Provoque une irritation des yeux.

Déclarations de précaution(s):

P264: Se laver les mains soigneusement après manipulation.

P305+P351+P338: EN CAS DE CONTACT AVEC LES YEUX: Rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.

P332+P313: En cas d'irritation cutanée: Obtenir des soins médicaux.

P337+P313: Si l'irritation oculaire persiste: Obtenir des soins médicaux.

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	99.08%	231-791-2
Chlorure de potassium	7447-40-7	0.40%	231-211-8
Acide borique	10043-35-3	0.33%	233-139-2
Hydroxide de sodium	1310-73-2	0.19%	215-185-5

Section 4 Mesures De Premiers Soins

INGESTION: Appeler un médecin ou un centre antipoison immédiatement. Provoquer le vomissement seulement si elle est informée par le personnel compétent médicaux. Ne jamais rien donner par la bouche à une personne inconsciente.

INHALATION: Sortir au grand air. Si elle ne respire pas, pratiquer la respiration artificielle. Si la respiration est difficile, donner de l'oxygène. Obtenir des soins médicaux.

CONTACT AVEC LES YEUX: Vérifier et enlever les lentilles de contact. Rincer abondamment à l'eau pendant au moins 15 minutes, en soulevant les paupières inférieures et supérieures de temps en temps. Obtenez une attention médicale immédiate.

ABSORPTION PAR LA PEAU: Enlever les vêtements contaminés. Rincer soigneusement avec du savon doux et d'eau. En cas d'irritation, consulter un médecin.

Section 5 Mesures De Lutte Contre l'Incendie

Moyens d'extinction: Utilisez des supports adaptés pour éteindre le feu à l'appui.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: En cas d'incendie, des gaz irritants et très toxiques peuvent être générés par la décomposition thermique ou la combustion.

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbent avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:	Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
	Chlorure de potassium	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Clair, liquide incolore. Odeur: Aucun odeur. Seuil de l'odeur: Données non disponibles. pH: 10.0 Point de fusion / congélation: Environ 0°C (32°F) (eau) Point d'ébullition: Environ 100°C (212°F) (eau) Point d'éclair: Données non disponibles	Taux d'évaporation (Eau = 1): <1 Inflammabilité (solide / gaz): Données non disponibles. Limites d'explosivité: Bas / Max: Données non disponibles Pression de vapeur (mm Hg): 14 (eau) Densité de vapeur (Air = 1): 0.7 (eau) Densité relative (gravité spécifique): Environ 1.0 (eau) Solubilité (s): Complet dans l'eau.	Coefficient de partage: Données non disponibles Auto-inflammation: Données non disponibles Température de décomposition: Données non disponibles. Viscosité: Données non disponibles. Formule moléculaire: Mélange Poids moléculaire: Mélange
--	--	--

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable
Polymérisation dangereuse: N'aura pas lieu.
Conditions à éviter: Les températures excessives qui causent l'évaporation.
Incompatibilités avec d'autres matériaux: Acides, alcalis, et l'air changera la capacité de l'amortisseur.
Produits de décomposition dangereux: Oxyde de bore et gaz de chlore.

Section 11 L'Information Toxicologique

Toxicité aiguë: Données non disponibles
La corrosion de la peau et l'irritation: Données non disponibles
Des lésions oculaires graves / irritation: Données non disponibles
Respiratoire ou sensibilisation de la peau: Données non disponibles
Mutagénicité des cellules germinales: Données non disponibles
Cancérogène: Données non disponibles
NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène reconnu ou présumé par NTP.
IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène probable, possible ou confirmé par IARC.
OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène ni comme cancérigène possible par OSHA.
Reproductive toxicity: Données non disponibles
STOT-exposition unique: Données non disponibles.
STOT-une exposition répétée: Données non disponibles
Risque d'aspiration: Données non disponibles
Effets d'une surexposition:
Inhalation: Peut être nocif en cas d'inhalation.
Ingestion: Peut être nocif en cas d'ingestion.
Peau: Peut causer une légère irritation.
Yeux: Peut causer une légère irritation.
Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond.
Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.
Informations complémentaires: RTECS #: Données non disponibles

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible
Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible
Toxicité pour les algues: Pas de données disponible
Persistance et dégradabilité: Pas de données disponible
Potentiel de bioaccumulation: Pas de données disponible
Mobilité dans le sol: Pas de données disponibles
Évaluation PBT et vPvB: Pas de données disponibles
Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable
Nom d'expédition: Non réglé
Classe de danger: Non applicable
Groupe d'emballage: Non applicable
Quantité à déclarer: Non
Polluant marin: Non
Exceptions: Non applicable
2012 ERG Guide #: Non applicable

Section 15 L'Information De Normalisation

Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
Phosphate de potassium	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. 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.

Section 1 L'information de produit chimique et de compagnie

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

**CHEMTREC 24 Numéros De Téléphone
De Secours D'Heure (800) 424-9300**
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	Solution de tampon pH9
Synonymes	"Kyle's Serum" (simulated)

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: AVERTISSEMENT

Pictogrammes: Aucune requise

Les organes cibles: Aucun connu.

Classification par le GHS:

Eye irritation (Category 2B)

Renseignements sur l'étiquette GHS: Mention de danger(s):

H316: Provoque une légère irritation cutanée.

H320: Provoque une irritation des yeux.

Déclarations de précaution(s):

P264: Se laver les mains soigneusement après manipulation.

P305+P351+P338: EN CAS DE CONTACT AVEC LES YEUX: Rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.

P337+P313: Si l'irritation oculaire persiste: Obtenir des soins médicaux.

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	99.18%	231-791-2
Chlorure de potassium	7447-40-7	0.40%	231-211-8
Acide borique	10043-35-3	0.33%	233-139-2
Hydroxide de sodium	1310-73-2	0.09%	215-185-5

Section 4 Mesures De Premiers Soins

INGESTION: Appeler un médecin ou un centre antipoison immédiatement. Provoquer le vomissement seulement si elle est informée par le personnel compétent médicaux. Ne jamais rien donner par la bouche à une personne inconsciente.

INHALATION: Sortir au grand air. Si elle ne respire pas, pratiquer la respiration artificielle. Si la respiration est difficile, donner de l'oxygène. Obtenir des soins médicaux.

CONTACT AVEC LES YEUX: Vérifier et enlever les lentilles de contact. Rincer abondamment à l'eau pendant au moins 15 minutes, en soulevant les paupières inférieures et supérieures de temps en temps. Obtenez une attention médicale immédiate.

ABSORPTION PAR LA PEAU: Enlever les vêtements contaminés. Rincer soigneusement avec du savon doux et d'eau. En cas d'irritation, consulter un médecin.

Section 5 Mesures De Lutte Contre L'Incendie

Moyens d'extinction: Utilisez des supports adaptés pour éteindre le feu à l'appui.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: En cas d'incendie, des gaz irritants et très toxiques peuvent être générés par la décomposition thermique ou la combustion.

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbent avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:	Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
	Chlorure de potassium	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Clair, liquide incolore. Odeur: Aucun odeur. Seuil de l'odeur: Données non disponibles. pH: 9.0 Point de fusion / congélation: Environ 0°C (32°F) (eau) Point d'ébullition: Environ 100°C (212°F) (eau) Point d'éclair: Données non disponibles	Taux d'évaporation (Eau = 1): <1 Inflammabilité (solide / gaz): Données non disponibles. Limites d'explosivité: Bas / Max: Données non disponibles Pression de vapeur (mm Hg): 14 (eau) Densité de vapeur (Air = 1): 0.7 (eau) Densité relative (gravité spécifique): Environ 1.0 (eau) Solubilité (s): Complet dans l'eau.	Coefficient de partage: Données non disponibles Auto-inflammation: Données non disponibles Température de décomposition: Données non disponibles. Viscosité: Données non disponibles. Formule moléculaire: Mélange Poids moléculaire: Mélange
---	--	--

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable
Polymérisation dangereuse: N'aura pas lieu.
Conditions à éviter: Les températures excessives qui causent l'évaporation.
Incompatibilités avec d'autres matériaux: Acides, alcalis, et l'air changera la capacité de l'amortisseur.
Produits de décomposition dangereux: Oxyde de bore et gaz de chlore.

Section 11 L'Information Toxicologique

Toxicité aiguë: Données non disponibles
La corrosion de la peau et l'irritation: Données non disponibles
Des lésions oculaires graves / irritation: Données non disponibles
Respiratoire ou sensibilisation de la peau: Données non disponibles
Mutagénicité des cellules germinales: Données non disponibles
Cancérogène: Données non disponibles
NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène reconnu ou présumé par NTP.
IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène probable, possible ou confirmé par IARC.
OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène ni comme cancérigène possible par OSHA.
Reproductive toxicity: Données non disponibles
STOT-exposition unique: Données non disponibles.
STOT-une exposition répétée: Données non disponibles
Risque d'aspiration: Données non disponibles
Effets d'une surexposition:
Inhalation: Peut être nocif en cas d'inhalation.
Ingestion: Peut être nocif en cas d'ingestion.
Peau: Peut causer une légère irritation.
Yeux: Peut causer une légère irritation.
Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond.
Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.
Informations complémentaires: RTECS #: Données non disponibles

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible
Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible
Toxicité pour les algues: Pas de données disponible
Persistance et dégradabilité: Pas de données disponible
Potentiel de bioaccumulation: Pas de données disponible
Mobilité dans le sol: Pas de données disponibles
Évaluation PBT et vPvB: Pas de données disponibles
Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable
Nom d'expédition: Non réglé
Classe de danger: Non applicable
Groupe d'emballage: Non applicable
Quantité à déclarer: Non
Polluant marin: Non
Exceptions: Non applicable
2012 ERG Guide #: Non applicable

Section 15 L'Information De Normalisation

Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
Phosphate de potassium	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. 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.

Section 1 L'information de produit chimique et de compagnie

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

**CHEMTREC 24 Numéros De Téléphone
De Secours D'Heure (800) 424-9300**
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	L'eau
Synonymes	"Abby's Serum" (simulated), "Alpha 1 Serum" (simulated)

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: Non classé

Pictogrammes: Non classé

Les organes cibles: Aucun connu.

Classification par le GHS: Non classé

Renseignements sur l'étiquette GHS: Mention de danger(s): Non classé

Déclarations de précaution(s): Non classé

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	100%	231-791-2

Section 4 Mesures De Premiers Soins

INGESTION:

INHALATION:

CONTACT AVEC LES YEUX:

ABSORPTION PAR LA PEAU:

Section 5 Mesures De Lutte Contre l'Incendie

Moyens d'extinction: Utilisez des supports adaptés pour éteindre le feu à l'appui.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: Données non disponibles

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbent avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:	Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
	L'eau	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Liquide, jaune clair. Odeur: Aucun odeur. Seuil de l'odeur: Données non disponibles. pH: Données non disponibles. Point de fusion / congélation: Environ 0°C (32°F) (eau) Point d'ébullition: 100oC @760mmHg (212oF) Point d'éclair: Non combustible	Taux d'évaporation (Eau = 1): 1 Inflammabilité (solide / gaz): Données non disponibles. Limites d'explosivité: Bas / Max: Données non disponibles Pression de vapeur (mm Hg): 14 Densité de vapeur (Air = 1): 0.7 Densité relative (gravité spécifique): 1.0 Solubilité (s): non applicable	Coefficient de partage: Données non disponibles Auto-inflammation: Données non disponibles Température de décomposition: Données non disponibles. Viscosité: Données non disponibles. Formule moléculaire: H ₂ O Poids moléculaire: 18.02
--	--	---

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable **Polymérisation dangereuse:** N'aura pas lieu.

Conditions à éviter: Données non disponibles.

Incompatibilités avec d'autres matériaux: Données non disponibles.

Produits de décomposition dangereux: Données non disponibles.

Section 11 L'Information Toxicologique

Toxicité aiguë: Oral-rat LD50: >90 mL/kg

La corrosion de la peau et l'irritation: Données non disponibles

Des lésions oculaires graves / irritation: Données non disponibles

Respiratoire ou sensibilisation de la peau: Données non disponibles

Mutagénicité des cellules germinales: Données non disponibles

Cancérogène: Données non disponibles

NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérogène reconnu ou présumé par NTP.

IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérogène probable, possible ou confirmé par IARC.

OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérogène ni comme cancérogène possible par OSHA.

Reproductive toxicity: Données non disponibles

STOT-exposition unique: Données non disponibles.

STOT-une exposition répétée: Données non disponibles

Risque d'aspiration: Données non disponibles

Effets d'une surexposition:

Inhalation: Peut être nocif en cas d'inhalation.

Ingestion: Peut être nocif en cas d'ingestion.

Peau: Peut causer une légère irritation.

Yeux: Peut causer une légère irritation.

Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond.

Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.

Informations complémentaires: RTECS #: Données non disponibles

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible

Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible

Toxicité pour les algues: Pas de données disponible

Persistance et dégradabilité: Pas de données disponible

Potentiel de bioaccumulation: Pas de données disponible

Mobilité dans le sol: Pas de données disponibles

Évaluation PBT et vPvB: Pas de données disponibles

Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable

Nom d'expédition: Non réglé

Classe de danger: Non applicable

Groupe d'emballage: Non applicable

Quantité à déclarer: Non

Polluant marin: Non

Exceptions: Non applicable

2012 ERG Guide #: Non applicable

Section 15 L'Information De Normalisation

Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
L'eau	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. 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.