

## The Best Ice Pack Flowchart

### Lesson Overview

In this lesson, students will use their knowledge of chemical and physical properties and chemical and physical changes to create an ice pack.

**SC Standards Addressed** (see extensions for additional standard possibilities)

**7.P.2B.4** Plan and conduct scientific investigations to answer questions about how physical and chemical changes affect the properties of different substances.

### Disciplinary Literacy Strategies

Strategy Used: collaborative grouping; Think, Ink, Pair, Share (TIPS)

### Computational Thinking

Tools:

Flowcharts

Cornerstone(s) Addressed:

- **Decomposition:** Students utilize prior knowledge of atomic structure, elements, compounds and mixtures to determine the correct combination (steps) of elements and/or compounds that create a decreased temperature in the bag.
- **Pattern Recognition:** Students determine the correct combination by utilizing the patterns in the periodic table for the elements they are given and their knowledge of the types of compounds.
- **Abstraction:** As students are testing their reactions, they will record other changes (physical and chemical: formation of gas, color changes and heat gain). All but the chemical reaction(s) that produce heat loss (i.e. the “ice pack”) must be removed, ignored and noted on the flowchart.
- **Algorithmic Thinking:** Students must create their procedural test and create their “recipe” for the ice pack. Both require algorithmic thinking.

### Lesson Plan

Time required: Three 55-minutes class periods

Focus Question(s): What are the properties of matter? How can the properties of matter be changed?

Disciplinary Vocabulary: chemical properties, physical properties, chemical changes, physical changes, temperature, gas, pH, indicator

Materials needed: (Post where they can be seen by all during the entire lesson with all formulas except \*)

- Ziploc™ bags (7 per group)
- calcium chloride  $\text{CaCl}_2$  samples
- phenol red (a pH indicator)  $\text{C}_{19}\text{H}_{14}\text{O}_5\text{S}^*$  samples
- sodium bicarbonate (baking soda)  $\text{NaHCO}_3$  samples
- dihydrogen oxide (water)  $\text{H}_2\text{O}$
- goggles and gloves (for each student)
- thermometer (optional)
- MSDS sheets for all chemicals (attached)
- Graduated cylinders (1 per group)

#### Safety Precautions:

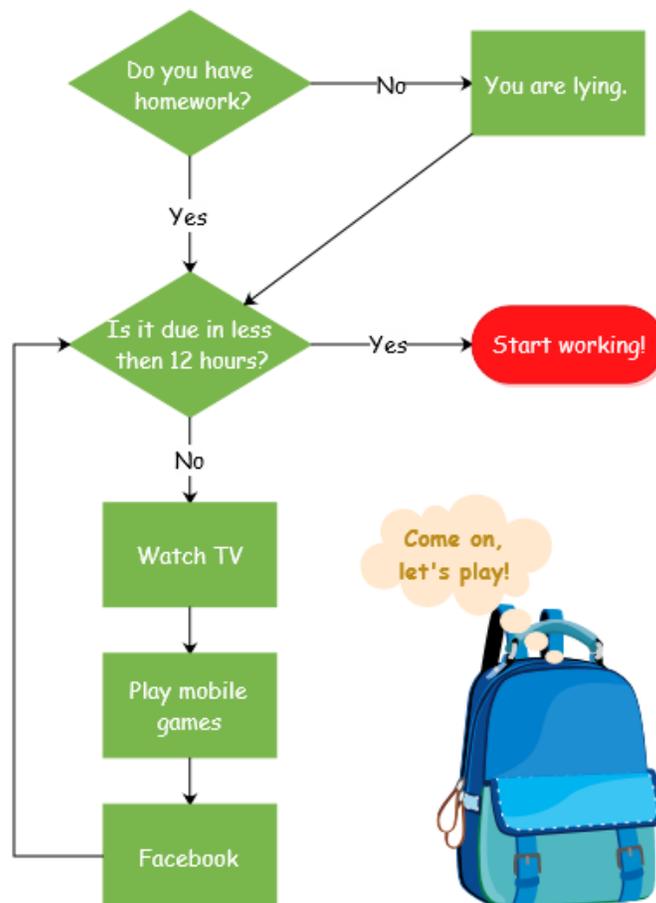
Calcium chloride is slightly toxic by ingestion. Phenol red is a dye solution and will stain skin and clothing. Be careful to mix the chemicals in the amounts called for in the procedure. Adding too much of the solids may result in excessive release of gases that are difficult to contain and may cause chemical splashing. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

### Engage:

Use the following challenge scenario: *The school nurse needs our help! Teachers are sick of always giving students ice for their injuries. It just melts and makes a mess in the classrooms. To eliminate the problem, you have been asked to create the most efficient (fast) and effective (coldest) ice pack, using only materials from the lab. NO MORE THAN 3 compounds combined per bag.*

- I. Provide the flowchart symbols handout.
- II. For **novice students**, **model** the flowcharting process: [your own example or the one provided (*below*)] – For **intermediate students**, **facilitate** the process asking questions for each step but allowing them to provide the answers. For **experienced students**, **skip** this step and proceed to “Explore” Step 4.
  1. The purpose and scope.

- a. What is your goal? Model: *To determine when to do homework.* The Nurses Challenge: *To create the best ice pack with the given materials and providing evidence for chemical reactions.*
- b. Identify start and end points to accomplish that goal(s). Model: *Start – Homework End – “Start Working”.* The Nurses Challenge: *Start – materials given and observable changes for chemical reactions End – Observable change of lowest temperature.* **NOTE: The starting point for this example is a question but it’s for effect – you could replace the top diamond with a box saying “You have homework” and remove the “You are lying” box.**
- c. Simple BUT detailed – Ask the right questions – it’s not quantity but quality. **NOTE: This is a good time to review the observable changes for chemical reactions – temperature, gas production, color change and solid production (*solid stuff that wasn’t there before mixing*)**



### Explore:

2. Identify steps and put them in order. Steps for this example are to decide when the homework is due and the 3 boxes of what to do when your homework isn't due within the next 12 hours.
  - a. Novice Students:
    - i. In groups, students identify the steps for the different combinations of compounds. Inform students that the solids will need to be dissolved. (*NOTE: There are more ways than one to do this so allow them space to figure out the most efficient way- OR NOT.*)
    - ii. As a whole class share some of the steps (*NOTE: Be sure to include steps involving, input and output data, as well as decision – the more generic the better.*)
  - b. Intermediate Students:
    - i. Skip this step and combine it with the next step.

3. Arrange the steps by type and corresponding shape: such as process, decision, data inputs or data outputs.
  - a. Novice students:
    - i. Identify each type in the example (*NOTE There are no data inputs and no data outputs*).
    - ii. Arrange the steps for testing combinations of compounds, by type, and assign the correct corresponding shape. (Example: “Does the combination of compounds produce bubbles – a gas?”: it creates a decision step and should be a diamond shape on the flowchart.)
  - b. Intermediate students:
    - i. Identify the steps needed to complete the flowchart and assign corresponding shapes.
    - ii. Arrange the steps in the most efficient way possible (*assist as needed to remove unnecessary steps*.)
4. Students draw a draft chart, either sketching or using a computer program or app (*see resources*).  
**NOTE:** *For experienced students this will be the first step after the scenario introduction – they will require more time for this than intermediate and novice students who just plug and chug.*
5. Students have their flowchart approved by the teacher before collecting the materials and beginning the challenge. **NOTE:** *By this step, the amount of time passed and what is needed is the same for each level of experience. **Remove combinations of Phenol Red, CaCl<sub>2</sub> and NaHCO<sub>3</sub>***
6. Once procedure is approved, students collect Ziploc’s, graduated cylinder and googles.

**Explain:**

7. Students follow their flowcharts and record their data for each combination they test. (*NOTE: Ensure students understand the safety precautions for each compound (See SDSs attached). Model what to do to collect the sample and what to do if the compound is spilled.*)
8. Provide students with the student handout (2 pages) (*NOTE: DO NOT provide prior to this point in the lesson*). {Adaptation: Students can create their own data collection and feedback form based on their flowcharts.}
  - a. Identify changes as physical and chemical.
  - b. Identify the combination of compounds that created the best ice pack.

**Elaborate:**

9. Students exchange procedures with another group and follow it (steps) for ONE combination of given compounds. Students then develop feedback for the group about their flowchart. *What worked? What did not work? What they would change? Etc. (See the student handout feedback form.)*

**Evaluate:**

10. Students use the feedback to edit their flowcharts.
11. Process the Data: Think, Ink, Pair, Share (TIPS - *see disciplinary literacy link above*) for each of the following: (*Project these one at a time: listen for misconceptions, assist as needed.*)
  - a. Cite specific evidence, from your data, which supports that chemical changes were taking place in some bags.
  - b. Which compounds when mixed together did not undergo a chemical reaction? What evidence do you have to support that claim?
  - c. What physical changes did you notice? How do you know these were physical and not chemical?

**Extension:**

Students can weigh the empty bag. The mass of each compound can be provided, and students can weigh the bag after any reactions and physical changes have completed – thus having a total mass before and after, for each combination. (*NOTE: It is advisable that you weigh each sample ahead of time – having these ready before the class is also strongly advised*). The mass data can then be used to support the SC science standard: 7.P.2B.5 “Develop and use models to explain how chemical reactions are supported by the law of conservation of matter”.

In addition, since they measure their own water, it would be easy to have them determine the density by the getting the mass of water in the cylinder (*mass of both – mass of empty cylinder*). This data can be used to support 7.P.2B.2 “Use mathematical and computational thinking to describe the relationship between the mass, volume, and density of a given substance”.

#### **Assessment Notes:**

Formative Assessments: Feedback from peers, the corrected flowcharts and TIPS to process the data.

Summative Assessment: Students turn in the observation and identification of the chemical and physical changes that occurred for each combination of compounds.

An alternative summative assessment might be a student generated lab report including a general description of physical and chemical changes as the introduction, the procedure they used to identify the correct combination, their data (observations) including the chemical and physical changes observed, their explanation, and a conclusion based on the “analysis and Results” section of the student handouts.

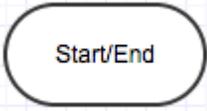
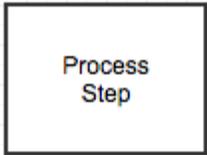
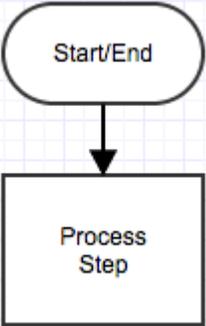
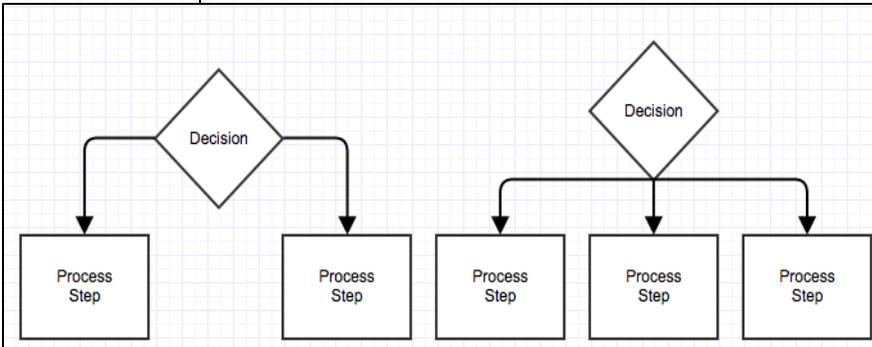
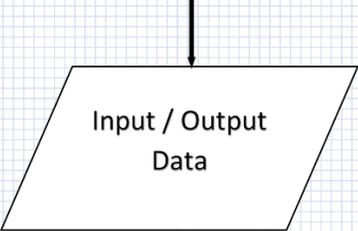
#### **Reference:**

Adapted from Risko, C. (2019). *Hot and Cold Packs: A Thermochemistry Activity*. Retrieved from <https://www.carolina.com/teacher-resources/Interactive/hot-and-cold-packs-a-thermochemistry-activity/tr29415.tr>

#### **Teacher Biographical Information**

Lesson Author: *Kimberly Scott, 7-year Science Teacher, 8<sup>th</sup> Grade Science*

The Basic Flowchart Symbols

<p><b>The Oval</b> An End or a Beginning</p>  <p>The oval is used to represent the start and end of a process. Use the same symbol again to show that your flowchart is complete.</p>	<p><b>The Rectangle</b> A Step in the Flowcharting Process</p>  <p>The rectangle is your go-to symbol. It represents any step in the process you're depicting and is the workhorse of the flowchart diagram. Give it a lump of sugar and it will love you forever.</p>
<p><b>The Arrow</b> Directional Flow</p>  <p>The arrow is used to guide the viewer along their flowcharting path. And while there are many different types of arrow tips to choose from, we recommend sticking with one for your entire flowchart. It's less confusing and generally more aesthetically pleasing.</p>	<p><b>The Diamond</b> Call for a Decision</p>  <p>The diamond symbolizes that a decision needs to be made. If there are only two choices, you can draw arrows directly from the diamond to the next step (example on the left). If there are more than two choices, you can draw them neatly by copying the example on the right.</p>
<p><b>The Parallelogram</b> Input/ Output (data)</p>  <p>Also referred to as the "Data Symbol," this shape represents data that is available for input or output, as well as representing resources used (reactants) or generated (products).</p>	

**Chemistry in a Bag** Name: \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

**Challenge:** Use the given chemicals to create the most efficient (easiest) and effective (coldest) ice pack. Given the following materials, develop a flowchart for testing them to meet the nurse’s challenge.

**Materials:** No More than 3 compounds combined at once (do NOT mix NaHCO<sub>3</sub>, CaCl<sub>2</sub> & Phenol Red)

- 3 scoops of sodium bicarbonate (baking soda) NaHCO<sub>3</sub>
- 10 ml of dihydrogen oxide (water) H<sub>2</sub>O
- 20 ml of phenolphthalein (phenol red a pH indicator) - C<sub>20</sub>H<sub>14</sub>O<sub>4</sub>
- 4 scoops of calcium chloride (From Walmart in the Vitamin and Mineral section) CaCl<sub>2</sub>
- Goggles
- 5 – 7 Ziploc bags (HINT: the zip on the bag allows you to close the system so that any reactants that form are kept in the bag, especially gases.)

**Follow your flowchart and test your combinations. Use the observation (Data) table below – be sure to complete the column headings for the changes (HINT what might you expect to observe if a chemical reaction has taken place?)** NOTE: You do not have to use all the Bags – EVEN IF you identify one combination of compounds that produces a decrease in temperature, IT MAY NOT be the best combination, so don’t stop until you have tested all combinations.

Bag number and contents (combinations of compounds)	Change 1:	Change 2:	Change 3:	Change 4:	Chemical Change? Y/N	Additional Observations
<b>Bag 1-</b>						
<b>Bag 2-</b>						
<b>Bag 3-</b>						
<b>Bag 4-</b>						
<b>Bag 5-</b>						
<b>Bag 6 -</b>						
<b>Bag 7 -</b>						

**CIRCLE** the best ice pack reaction (bag number with combination of compounds)

After completing the table above write your group members names as the designers at the top of the flowchart feedback form (next page) then exchange flowcharts and feedback forms with another group.

**Choose one** of your combinations from above to test, using their flowchart, and enter your data below.

Bag number and contents (combinations of compounds)	Change 1:	Change 2:	Change 3:	Change 4:	Chemical Change? Y/N	Additional Observations

Once completed, **return the feedback form and flowchart** to its original owners.

Names of the designers: \_\_\_\_\_

**Flowchart Feedback**

Select the appropriate description next to each category for the flowchart you are testing. Once you have completed the test, give the completed feedback form and the flowchart, back to the group who gave it to you to test.

**Names of the testers:**

<b>Flow</b>	The flow chart is logical and the directions help the reader complete the task efficiently and effectively.	The flow chart is logical and the directions allow the reader to complete the task effectively. (Efficiency is moderate)	The flow chart logic is present but there is a question as to which step goes in which order. (Efficiency is Low/ Effectiveness is low)	There is no logic to the flow chart. The flow chart has no order and is hard to understand. (Not efficient & Ineffective)
<b>Direction</b>	Arrows are present in the flow chart that guide the reader through the steps. The arrows compliment the chart.	Arrows are present in the flow chart and guide the reader through the steps.	Arrows are present, but they do not guide the reader or there are not enough arrows.	There are no arrows in the flow chart.
<b>Organization</b>	The order, presentation, and structure guide the reader purposefully through the steps.	The order allows the reader to move through the text without undue confusion.	Order is reasonably appropriate. Some information could be dropped or relocated.	

**Additional comments:** *Answer the questions below and feel free to add comments for the good of the group.*

What went well?

What didn't go so well? What solutions might you have?

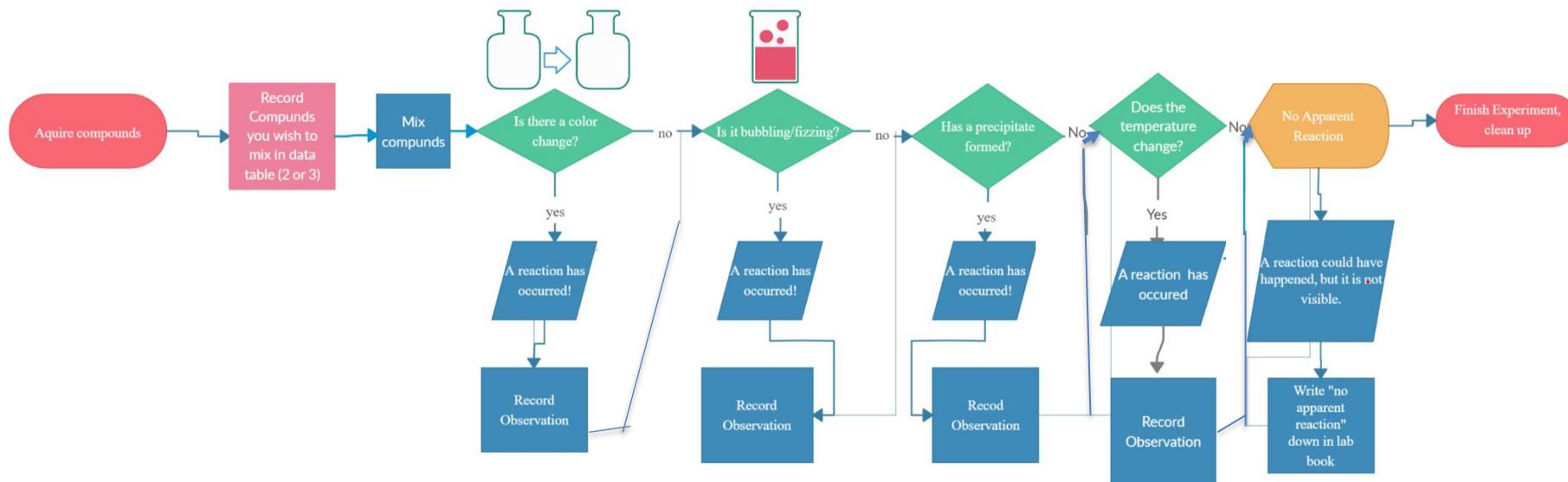
What other changes might you suggest? (*efficiency and effectiveness*)

**KEY**

## Possible Combinations

<i>Bag contents (combinations of compounds)</i>	<i>Gas Produced:</i>	<i>Temperature Change:</i>	<i>Color Change:</i>	<i>Precipitate formed</i>	<i>Chemical Change?</i>	<i>Additional Observations</i>
Calcium Chloride CaCl <sub>2</sub> and Sodium Bicarbonate NaHCO <sub>3</sub>	N	N	N	N	N	No reaction. White solids retain their individual appearance after mixing.
Calcium Chloride and Phenol Red	N	Increase	N	N	Y	White solid mostly dissolves; final mixture is slightly cloudy. Bag is quite hot. Final color is red (no change from initial indicator color.)
CaCl <sub>2</sub> & H <sub>2</sub> O	N	Increases	Y	N	Y	Solid dissolves into solution and forms a cloudy mixture, then clear; solution becomes warm to touch
NaHCO <sub>3</sub> and Phenol Red	N	Decreases	N	N	Y	White solid begins to dissolve into solution, but does not dissolve completely. Final solution is cloudy or "chalky" pink (white solid and red liquid). Bag is cool to the touch.
NaHCO <sub>3</sub> & H <sub>2</sub> O	N	Increases	N	N	Y	White solid partially dissolves. Bag gets warm to the touch. Final solution is chalky white.
Phenol Red & H <sub>2</sub> O	N	N	N	N	N	Dilutes from red to pink no other noticeable change
CaCl <sub>2</sub> , NaHCO <sub>3</sub> & H <sub>2</sub> O	Y	Increases	Y	Y	Y	Solution bubbles and fizzing noise is heard. Bag expands and feels tight. Bag is warm (hot) to the touch. Solids combine or react with each other; final mixture is chalky white.
CaCl <sub>2</sub> , Phenol Red & H <sub>2</sub> O	N	Increases	N	N	Y	White solid dissolves. Bag feels hot to the touch. Color changes to paler shade of red.
NaHCO <sub>3</sub> , Phenol Red & H <sub>2</sub> O	N	Decreases	N	N	Y	White solid partially dissolves. Cup feels slightly cold. Final mixture is chalky and pink due to white solid and red liquid.

Possible Flowchart





## SAFETY DATA SHEET

Creation Date 29-Jan-2010

Revision Date 23-Jan-2018

Revision Number 6

**Key:**

Some possible investigations:

Some possible flowcharts:

### 1. Identification

**Product Name****Sodium bicarbonate****Cat No. :****AC447100000, AC447100010, AC447102500****CAS-No** 144-55-8 **Synonyms**

Sodium hydrogen carbonate

**Recommended Use**

Laboratory chemicals.

**Uses advised against**Not for food, drug, pesticide or biocidal product use [Details of the supplier of](#)[the safety data sheet](#)**Company**Fisher Scientific  
One Reagent Lane  
Fair Lawn, NJ 07410  
Tel: (201) 796-7100Acros Organics  
One Reagent Lane  
Fair Lawn, NJ 07410**Emergency Telephone Number**For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99**CHEMTREC** Tel. No. **US**:001-800-424-9300 / **Europe**:001-703-527-3887

### 2. Hazard(s) identification

**Classification**

This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

**Label Elements****Hazards not otherwise classified (HNOC)**

None identified

### 3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Sodium bicarbonate	144-55-8	>95

#### 4. First-aid measures

<b>Eye Contact</b>	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
<b>Skin Contact</b>	Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur. Move to fresh air. Get medical attention immediately if symptoms occur.
<b>Inhalation</b>	
<b>Ingestion</b>	Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur. None reasonably foreseeable.
<b>Most important symptoms and effects</b>	
<b>Notes to Physician</b>	Treat symptomatically

#### 5. Fire-fighting measures

<b>Suitable Extinguishing Media</b>	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
<b>Unsuitable Extinguishing Media</b>	No information available
<b>Flash Point</b>	No information available
<b>Method -</b>	No information available
<b>Autoignition Temperature</b>	
<b>Explosion Limits</b>	
<b>Upper</b>	No data available
<b>Lower</b>	No data available
<b>Sensitivity to Mechanical Impact</b>	No information available
<b>Sensitivity to Static Discharge</b>	No information available

#### Specific Hazards Arising from the Chemical

Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

#### Hazardous Combustion Products

Sodium oxides

#### Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

#### NFPA

Health	Flammability	Instability	Physical hazards
0	0	1	N/A

#### 6. Accidental release measures

<b>Personal Precautions</b>	Ensure adequate ventilation. Use personal protective equipment. Avoid dust formation.
<b>Environmental Precautions</b>	Should not be released into the environment.

**Methods for Containment and Clean Up** Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid dust formation.

#### 7. Handling and storage

<b>Handling</b>	Wear personal protective equipment. Ensure adequate ventilation. Avoid ingestion and inhalation. Avoid contact with skin, eyes and clothing. Avoid dust formation.
<b>Storage</b>	Keep containers tightly closed in a dry, cool and well-ventilated place.

## 8. Exposure controls / personal protection

<b>Exposure Guidelines</b>	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
<b>Engineering Measures</b>	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.
<b>Personal Protective Equipment</b>	
<b>Eye/face Protection</b>	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
<b>Skin and body protection</b>	Wear appropriate protective gloves and clothing to prevent skin exposure.
<b>Respiratory Protection</b>	No protective equipment is needed under normal use conditions.
<b>Hygiene Measures</b>	Handle in accordance with good industrial hygiene and safety practice.

## 9. Physical and chemical properties

<b>Physical State</b>	Powder Solid
<b>Appearance</b>	White
<b>Odor</b>	Odorless
<b>Odor Threshold</b>	No information available
<b>pH</b>	8.3 0.1M aq. solution
<b>Melting Point/Range</b>	270 °C / 518 °F
<b>Boiling Point/Range</b>	No information available
<b>Flash Point</b>	No information available
<b>Evaporation Rate</b>	Not applicable
<b>Flammability (solid, gas)</b>	No information available
<b>Flammability or explosive limits Upper</b>	No data available
<b>Lower</b>	No data available
<b>Vapor Pressure</b>	No information available
<b>Vapor Density</b>	Not applicable
<b>Specific Gravity</b>	No information available
<b>Solubility</b>	Slightly soluble in water
<b>Partition coefficient; n-octanol/water</b>	No data available
<b>Autoignition Temperature Decomposition Temperature</b>	> 50°C
<b>Viscosity</b>	Not applicable
<b>Molecular Formula</b>	C H Na O3
<b>Molecular Weight</b>	84.01

## 10. Stability and reactivity

<b>Reactive Hazard</b>	None known, based on information available
<b>Stability</b>	Hygroscopic.
<b>Conditions to Avoid</b>	Avoid dust formation. Incompatible products. Exposure to moist air or water. Excess heat. Temperatures above 50°C.
<b>Incompatible Materials</b>	Strong oxidizing agents, Acids
<b>Hazardous Decomposition Products</b>	Sodium oxides
<b>Hazardous Polymerization</b>	Hazardous polymerization does not occur.
<b>Hazardous Reactions</b>	None under normal processing.

## 11. Toxicological information

**Acute Toxicity**

**Product Information Component Information**

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium bicarbonate	LD50 = 4220 mg/kg ( Rat )	Not listed	Not listed

**Toxicologically Synergistic** No information available

**Products**

**Delayed and immediate effects as well as chronic effects from short and long-term exposure**

**Irritation** No information available

**Sensitization** No information available

**Carcinogenicity** The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Sodium bicarbonate	144-55-8	Not listed				

**Mutagenic Effects** No information available

**Reproductive Effects** No information available.

**Developmental Effects** No information available.

**Teratogenicity** No information available.  
None known

**STOT - single exposure**

**STOT - repeated exposure** None known

**Aspiration hazard** No information available

**Symptoms / effects- both acute and delayed** No information available

**Endocrine Disruptor Information** No information available

**Other Adverse Effects** The toxicological properties have not been fully investigated.

**12. Ecological information**

**Ecotoxicity**

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Sodium bicarbonate	EC50: 650 mg/L/120h	LC50: 8250 - 9000 mg/L, 96h static (Lepomis macrochirus)	-	EC50: 2350 mg/L/48h

**Persistence and Degradability** Soluble in water Persistence is unlikely based on information available.

<b>Bioaccumulation/ Accumulation</b>	No information available.
<b>Mobility</b>	Will likely be mobile in the environment due to its water solubility.

### 13. Disposal considerations

<b>Waste Disposal Methods</b>	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.
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### 14. Transport information

<b>DOT</b>	Not regulated
<b>TDG</b>	Not regulated
<b>IATA</b>	Not regulated
<b>IMDG/IMO</b>	Not regulated

### 15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

#### International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Sodium bicarbonate	X	X	-	205-633-8	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA. S - Indicates a substance that is identified in a proposed or final Significant New Use Rule T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

#### U.S. Federal Regulations

<b>TSCA 12(b)</b>	Not applicable
<b>SARA 313</b>	Not applicable
<b>SARA 311/312 Hazard Categories</b>	See section 2 for more information
<b>CWA (Clean Water Act)</b>	Not applicable
<b>Clean Air Act</b>	Not applicable
<b>OSHA Occupational Safety and Health Administration</b>	Not applicable
<b>CERCLA</b>	Not applicable
<b>California Proposition 65</b>	This product does not contain any Proposition 65 chemicals

Not applicable

**U.S. State Right-to-Know Regulations**

**U.S. Department of Transportation**

Reportable Quantity (RQ): N

DOT Marine Pollutant N

DOT Severe Marine Pollutant N

**U.S. Department of Homeland Security**

This product does not contain any DHS chemicals.

**Other International Regulations**

**Mexico - Grade** No information available

**16. Other information**

**Prepared By** Regulatory Affairs  
 Thermo Fisher Scientific  
 Email: EMSDS.RA@thermofisher.com

**Creation Date** 29-Jan-2010

**Revision Date** 23-Jan-2018

**Print Date** 23-Jan-2018

**Revision Summary** This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

**Disclaimer**

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

**End of SDS**



## SAFETY DATA SHEET

Creation Date 14-Aug-2009

Revision Date 17-Jan-2018

Revision Number 3

### 1. Identification

<b>Product Name</b>	<b>Calcium chloride</b>
<b>Cat No. :</b>	<b>C77-212; C77-500; C614-3; C614-10; C614-500</b>
<b>CAS-No</b>	10043-52-4
<b>Synonyms</b>	Dowflake; Calpus; Caltac (Anhydrous; Pellets; Certified; Desiccant; 4-20 Mesh and Finer)
<b>Recommended Use</b>	Laboratory chemicals.
<b>Uses advised against</b>	Not for food, drug, pesticide or biocidal product use
<b><u>Details of the supplier of the safety data sheet</u></b>	

#### Company

Fisher Scientific  
 One Reagent Lane  
 Fair Lawn, NJ 07410  
 Tel: (201) 796-7100

#### **Emergency Telephone Number**

CHEMTRECÒ, Inside the USA: 800-424-9300  
 CHEMTRECÒ, Outside the USA: 001-703-527-3887

## 2. Hazard(s) identification

### Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious Eye Damage/Eye Irritation	Category 2
Combustible dust	Yes

### Label Elements

**Signal Word** Warning

#### **Hazard Statements**

May form combustible dust concentrations in air  
 Causes serious eye irritation



#### **Precautionary Statements**

##### **Prevention**

Wash face, hands and any exposed skin thoroughly after handling

Wear eye/face protection

**Inhalation**

Call a POISON CENTER or doctor/physician if you feel unwell

**Eyes**

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention

**Storage**

Store in a well-ventilated place. Keep container tightly closed

Store locked up

**Disposal**

Dispose of contents/container to an approved waste disposal plant

**Hazards not otherwise classified (HNOC)**

None identified

**3. Composition/Information on Ingredients**

Component	CAS-No	Weight %
Calcium chloride	10043-52-4	>95

**4. First-aid measures****Eye Contact**

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

**Skin Contact**

Wash off immediately with plenty of water for at least 15 minutes. Get medical attention if symptoms occur.

**Inhalation**

Move to fresh air. If breathing is difficult, give oxygen. Get medical attention if symptoms occur.

**Ingestion**

Do not induce vomiting. Obtain medical attention.

No information available.

**Most important symptoms and effects****Notes to Physician**

Treat symptomatically

**5. Fire-fighting measures****Suitable Extinguishing Media**

Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.

**Unsuitable Extinguishing Media**

No information available

**Flash Point**

No information available

**Method -**

No information available

**Autoignition Temperature****Explosion Limits****Upper**

No data available

**Lower**

No data available

**Sensitivity to Mechanical Impact** No information available

**Sensitivity to Static Discharge** No information available

**Specific Hazards Arising from the Chemical**

Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

**Hazardous Combustion Products**

Hydrogen chloride gas Chlorine

**Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

**NFPA**

Health 2	Flammability 0	Instability 1	Physical hazards N/A
<b>6. Accidental release measures</b>			

<b>Personal Precautions</b>	Ensure adequate ventilation. Use personal protective equipment. Avoid dust formation.
<b>Environmental Precautions</b>	Should not be released into the environment. See Section 12 for additional ecological information.
<b>Methods for Containment and Up</b>	<b>d Clean</b> Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid dust formation.

<b>7. Handling and storage</b>
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<b>Handling</b>	Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Avoid dust formation.
<b>Storage</b>	Keep containers tightly closed in a dry, cool and well-ventilated place.

<b>8. Exposure controls / personal protection</b>
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<b>Exposure Guidelines</b>	
<b>Engineering Measures</b>	Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.
<b>Personal Protective Equipment</b>	
<b>Eye/face Protection</b>	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
<b>Skin and body protection</b>	Wear appropriate protective gloves and clothing to prevent skin exposure.
<b>Respiratory Protection</b>	No protective equipment is needed under normal use conditions.
<b>Hygiene Measures</b>	Handle in accordance with good industrial hygiene and safety practice.

<b>9. Physical and chemical properties</b>
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<b>Physical State</b>	Solid
<b>Appearance</b>	Beige
<b>Odor</b>	Odorless
<b>Odor Threshold</b>	No information available
<b>pH</b>	8-10 100 g/L aq.sol
<b>Melting Point/Range</b>	782 °C / 1439.6 °F
<b>Boiling Point/Range</b>	> 1600 °C / > 2912 °F @ 760 mmHg
<b>Flash Point</b>	No information available
<b>Evaporation Rate</b>	Not applicable
<b>Flammability (solid,gas)</b>	No information available
<b>Flammability or explosive limits</b>	
<b>Upper</b>	No data available
<b>Lower</b>	No data available
<b>Vapor Pressure</b>	No information available
<b>Vapor Density</b>	Not applicable
<b>Specific Gravity</b>	No information available
<b>Solubility</b>	Soluble in water

Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	Ca Cl <sub>2</sub>
Molecular Weight	110.99

## 10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under recommended storage conditions. Hygroscopic.
Conditions to Avoid	Incompatible products. Exposure to moist air or water. Excess heat. Avoid dust formation.
Incompatible Materials	Strong oxidizing agents, Metals
Hazardous Decomposition Products	Hydrogen chloride gas, Chlorine
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

## 11. Toxicological information

### Acute Toxicity

### Product Information

#### Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium chloride	2301 mg/kg ( Rat )	LD50 > 5000 mg/kg ( Rabbit )	Not listed

Toxicologically Synergistic Products	No information available
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### Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	Severe eye irritant
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Sensitization	No information available
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The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Calcium chloride	10043-52-4	Not listed				

Mutagenic Effects	Mutagenic effects have occurred in experimental animals.
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Reproductive Effects	No information available.
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Developmental Effects	No information available.
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Teratogenicity	No information available.
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STOT - single exposure	None known
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STOT - repeated exposure	None known
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Aspiration hazard	No information available
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Symptoms / effects, both acute and delayed	No information available
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Endocrine Disruptor Information	No information available
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Other Adverse Effects	Tumorigenic effects have been reported in experimental animals. See actual entry in RTECS for complete information.
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## 12. Ecological information

### Ecotoxicity

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Calcium chloride	Listed	Lepomis macrochirus: LC50: 10650 mg/L/96h	Not listed	EC50: 52 mg/L/48h

**Persistence and Degradability** Soluble in water Persistence is unlikely based on information available.

**Bioaccumulation/ Accumulation** No information available.

#### Mobility

Will likely be mobile in the environment due to its water solubility.

## 13. Disposal considerations

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

## 14. Transport information

**DOT** Not regulated

**TDG** Not regulated

**IATA** Not regulated

**IMDG/IMO** Not regulated

## 15. Regulatory information

### International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Calcium chloride	X	X	-	233-140-8	-		X	X	X	X	X

#### Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA. S - Indicates a substance that is identified in a proposed or final Significant New Use Rule T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

## U.S. Federal Regulations

**TSCA 12(b)** Not applicable

**SARA 313** Not applicable

**SARA 311/312 Hazard Categories** See section 2 for more information

**CWA (Clean Water Act)** Not applicable

**Clean Air Act** Not applicable

**OSHA Occupational Safety and Health Administration** Not applicable

**CERCLA** Not applicable

**California Proposition 65** This product does not contain any Proposition 65 chemicals

**U.S. State Right-to-Know** Not applicable **Regulations**

#### **U.S. Department of Transportation**

Reportable Quantity (RQ): N  
DOT Marine Pollutant N DOT Severe Marine  
Pollutant N

#### **U.S. Department of Homeland Security**

This product does not contain any DHS chemicals.

#### **Other International Regulations**

**Mexico - Grade** No information available

## **16. Other information**

**Prepared By** Regulatory Affairs  
Thermo Fisher Scientific  
Email: EMSDS.RA@thermofisher.com

**Creation Date** 14-Aug-2009

**Revision Date** 17-Jan-2018

**Print Date** 17-Jan-2018

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**End of SDS**



## SAFETY DATA SHEET

Creation Date 13-Oct-2014

Revision Date 17-Jan-2018

Revision Number 3

### 1. Identification

**Product Name** Phenol Red, Free Acid (Certified ACS)

**Cat No. :** P74-10

**Synonyms** Sulfonphthal; Phenolsulphonphthalein; Phenolsulfonphthalein

**Recommended Use** Laboratory chemicals.

**Uses advised against** Not for food, drug, pesticide or biocidal product use

**Details of the supplier of the safety data sheet**

### Company

Fisher Scientific  
One Reagent Lane  
Fair Lawn, NJ 07410  
Tel: (201) 796-7100

### Emergency Telephone Number

CHEMTRECÒ, Inside the USA: 800-424-9300  
CHEMTRECÒ, Outside the USA: 001-703-527-3887

### 2. Hazard(s) identification

#### Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Specific target organ toxicity (single exposure) Target Organs - Respiratory system.	Category 3

### Label Elements

**Signal Word** Warning

#### Hazard Statements

Causes skin irritation  
Causes serious eye irritation  
May cause respiratory irritation



#### Precautionary Statements

##### Prevention

Wash face, hands and any exposed skin thoroughly after handling

Wear protective gloves/protective clothing/eye protection/face protection

Avoid breathing dust/fume/gas/mist/vapors/spray

Use only outdoors or in a well-ventilated area

#### Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Call a POISON CENTER or doctor/physician if you feel unwell

#### Skin

IF ON SKIN: Wash with plenty of soap and water

If skin irritation occurs: Get medical advice/attention

Take off contaminated clothing and wash before reuse

#### Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention

#### Storage

Store in a well-ventilated place. Keep container tightly closed

Store locked up

#### Disposal

Dispose of contents/container to an approved waste disposal plant

#### Hazards not otherwise classified (HNOC)

None identified

### 3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Phenol red	143-74-8	100

### 4. First-aid measures

<b>Eye Contact</b>	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
<b>Skin Contact</b>	Wash off immediately with plenty of water for at least 15 minutes. Get medical attention if symptoms occur.
<b>Inhalation</b>	Move to fresh air. If breathing is difficult, give oxygen. Get medical attention if symptoms occur.
<b>Ingestion</b>	Do not induce vomiting. Obtain medical attention. No information available.
<b>Most important symptoms and effects</b>	
<b>Notes to Physician</b>	Treat symptomatically

### 5. Fire-fighting measures

<b>Suitable Extinguishing Media</b>	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
<b>Unsuitable Extinguishing Media</b>	No information available
<b>Flash Point</b>	No information available
<b>Method -</b>	No information available
<b>Autoignition Temperature</b>	Not applicable
<b>Explosion Limits</b>	
<b>Upper</b>	No data available
<b>Lower</b>	No data available
<b>Sensitivity to Mechanical Impact</b>	No information available
<b>Sensitivity to Static Discharge</b>	No information available

**Specific Hazards Arising from the Chemical**

Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

**Hazardous Combustion Products**

Carbon monoxide (CO) Carbon dioxide (CO<sub>2</sub>) Sulfur oxides

**Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

**NFPA**

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

**6. Accidental release measures****Personal Precautions**

Use personal protective equipment. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes and clothing.

**Environmental Precautions**

Avoid release to the environment.

• Clean Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid dust formation.

**Methods for Containment and Up****7. Handling and storage****Handling**

Wear personal protective equipment. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation.

**Storage**

Keep containers tightly closed in a dry, cool and well-ventilated place.

**8. Exposure controls / personal protection****Exposure Guidelines**

This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

**Engineering Measures**

Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

**Personal Protective Equipment****Eye/face Protection**

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin and body protection**

Wear appropriate protective gloves and clothing to prevent skin exposure.

**Respiratory Protection**

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

**Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

**9. Physical and chemical properties**

<b>Physical State</b>	Solid
<b>Appearance</b>	Red
<b>Odor</b>	Odorless
<b>Odor Threshold</b>	No information available
<b>pH</b>	No information available
<b>Melting Point/Range</b>	> 300 °C / 572 °F
<b>Boiling Point/Range</b>	No information available
<b>Flash Point</b>	No information available
<b>Evaporation Rate</b>	No information available

<b>Flammability (solid, gas)</b>	No information available
<b>Flammability or explosive limits</b>	
<b>Upper</b>	No data available
<b>Lower</b>	No data available
<b>Vapor Pressure</b>	No information available
<b>Vapor Density</b>	No information available
<b>Specific Gravity</b>	No information available
<b>Solubility</b>	Slightly soluble in water
<b>Partition coefficient; n-octanol/water</b>	No data available
<b>Autoignition Temperature</b>	Not applicable
<b>Decomposition Temperature</b>	No information available
<b>Viscosity</b>	No information available
<b>Molecular Formula</b> C19H14O5S <b>Molecular Weight</b>	354.155

## 10. Stability and reactivity

<b>Reactive Hazard</b>	None known, based on information available
<b>Stability</b>	Stable under normal conditions.
<b>Conditions to Avoid</b>	Avoid dust formation. Incompatible products. Exposure to light. Excess heat.
<b>Incompatible Materials</b>	Strong oxidizing agents
<b>Hazardous Decomposition Products</b>	Carbon monoxide (CO), Carbon dioxide (CO <sub>2</sub> ), Sulfur oxides
<b>Hazardous Polymerization</b>	Hazardous polymerization does not occur.
<b>Hazardous Reactions</b>	None under normal processing.

## 11. Toxicological information

### Acute Toxicity

**Product Information** No acute toxicity information is available for this product

**Component Information**  
**Toxicologically Synergistic Products** No information available

### Delayed and immediate effects as well as chronic effects from short and long-term exposure

<b>Irritation</b>	Irritating to eyes, respiratory system and skin
<b>Sensitization</b>	No information available
<b>Carcinogenicity</b>	The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Phenol red	143-74-8	Not listed				

<b>Mutagenic Effects</b>	No information available	
<b>Reproductive Effects</b>	No information available.	
<b>Developmental Effects</b>	No information available. <b>Teratogenicity</b>	No

information available.

**STOT - single exposure** Respiratory system **STOT - repeated exposure** None known

**Aspiration hazard** No information available

**Symptoms/ effects,** No information available

**both acute and delayed**

**Endocrine Disruptor Information** No information available

**Other Adverse Effects** The toxicological properties have not been fully investigated.

## 12. Ecological information

### Ecotoxicity

Do not empty into drains.

**Persistence and Degradability** No information available

**Bioaccumulation/ Accumulation** No information available.

**Mobility** No information available.

## 13. Disposal considerations

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

## 14. Transport information

**DOT** Not regulated

**TDG** Not regulated

**IATA** Not regulated

**IMDG/IMO** Not regulated

## 15. Regulatory information

**All of the components in the product are on the following Inventory lists:** Australia X = listed China Canada The product is classified and labeled according to EC directives or corresponding national laws The product is classified and labeled in accordance with Directive 1999/45/EC Europe TSCA Korea Philippines Japan **International Inventories**

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Phenol red	X	X	-	205-609-7	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA. S - Indicates a substance that is identified in a proposed or final Significant New Use Rule T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

## U.S. Federal Regulations

**TSCA 12(b)** Not applicable

**SARA 313** Not applicable

**SARA 311/312 Hazard Categories** See section 2 for more information

**CWA (Clean Water Act)** Not applicable

**Clean Air Act** Not applicable

**OSHA Occupational Safety and Health Administration**  
Not applicable

**CERCLA** Not applicable

**California Proposition 65** This product does not contain any Proposition 65 chemicals  
Not applicable

**U.S. State Right-to-Know Regulations**  
**U.S. Department of Transportation**

Reportable Quantity (RQ): N  
DOT Marine Pollutant N DOT Severe Marine  
Pollutant N

**U.S. Department of Homeland Security**  
This product does not contain any DHS chemicals.

**Other International Regulations**

**Mexico - Grade** No information available

**16. Other information**

**Prepared By** Regulatory Affairs  
Thermo Fisher Scientific  
Email: EMSDS.RA@thermofisher.com

**Creation Date** 13-Oct-2014

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**End of SDS**