

Keeping a Balance: Homeostasis and Negative Feedback

Teacher Information



Summary

Students read about homeostasis and negative feedback. They do a hands-on simulation to show how “Cupples” maintain homeostasis. They use a graphic organizer to illustrate feedback control mechanisms for regulating body temperature. They apply what they learned to answer questions about blood glucose regulation.

Core Concepts

- Homeostasis, a dynamic equilibrium or steady state, keeps the internal environment within certain limits.
- Feedback mechanisms maintain homeostasis by detecting deviations from the normal state and take corrective actions to return systems to the normal state.
- Disease or death may result if an organism fails to maintain homeostasis.

Time Required

Three 40-minute class periods

Kit contains

- 1 *Negative Feedback Graphic Organizer*
- 1 sheet with blue, green and pink cards for use with graphic organizer
- 1 tube of “Cupple Blood”
- 1 tube of “Sugar ”
- 1 tube of “Exercise”
- Droppers labeled “Sugar ” and “Exercise”
- 1 small cup labeled “Cupple”

Teacher Provides

- Scissors (or save class time by pre-cutting the blue, pink, and green sheets of cards)
- Safety goggles
- Paper towel for cleanup

Warning: Choking Hazard

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

Teacher Note:

The “Cupple Blood” should be green at the start of the lab activity. The “Cupple Blood” may have turned blue during transit and/or storage. If you notice that the “Cupple Blood” is blue, just add a very tiny drop of vinegar to the tube of “Cupple Blood” until it turns green.

Reusing *Homeostasis* 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:

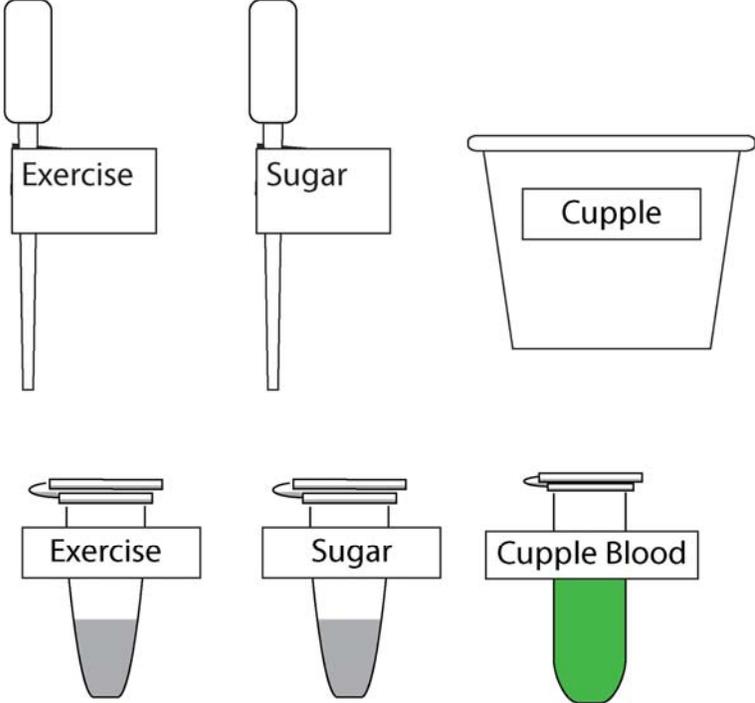
| Discard | Rinse with water and dry with paper towel | Return to kit |
|--|---|---|
| <ul style="list-style-type: none">Liquid in the “Cupple” | <ul style="list-style-type: none">All droppersPlastic cup labeled “Cupple” | <ul style="list-style-type: none">All labeled microtubesAll labeled droppers (rinsed)Microtube racks<i>Negative Feedback Graphic Organizer</i>All colored cards |

* Note: Consider laminating printed parts of the kits (the *Negative Feedback Graphic Organizer* and the colored cards) that may be reused.

Refills for *Homeostasis* kits are available at www.sciencetakeout.com. The **10 Kit Refill Pack** includes the following materials:

- Instructions and Quick Guide for refilling kits
- 15 ml “Cupple Blood”
- 15 ml “Exercise”
- 15 ml “Sugar”
- 3 graduated transfer pipets (for refilling the microtubes)

Kit Contents Quick Guide



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. Material Safety Data Sheets (MSDS) provide specific safety information regarding the chemical contents of the kits. MSDS 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, 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.

Keeping a Balance: Homeostasis and Negative Feedback

Teacher Answer Key

Part I: Homeostasis and Negative Feedback

Organisms are continually exposed to changes in their external and internal environments. To be healthy, organisms must maintain **homeostasis**, a “dynamic equilibrium” or “steady state,” which keeps their internal environment balanced within normal limits. Failure to maintain homeostasis may result in disease or death.

To maintain homeostasis, organisms use **negative feedback mechanisms** that detect changes from the **set point**, (the normal state) and trigger appropriate responses that return their body systems to the set point.



1. Use the information in the box above to write definitions for the following words:

- Homeostasis

Homeostasis, a “dynamic equilibrium” or “steady state,” which keeps their internal environment balanced within certain limits.

- Negative feedback mechanism

Used by organisms to detect changes from the set point, (the normal state) and trigger appropriate responses that return their systems to the set point.

- Set point

The normal state for a system.

2. Why are feedback mechanisms important?

They maintain homeostasis or they keep the body’s internal environment constant.

3. The process of homeostasis is like driving a car at the speed limit (55 miles per hour).

- What is the set point for driving a car?

55 miles per hour

- If you detect that the speed of the car is above the set point, what response should you make?

Apply the brakes and/or take foot off the gas to slow the car down.

- If you detect the speed of the car is below the set point, what response should you make?

Take foot off the brake and/or apply gas to speed the car up.



4. Cut along the dotted lines on the blue *Regulating the Speed of a Car* cards in your lab kit.

5. Arrange the cards in the boxes on the *Negative Feedback Graphic Organizer* sheet to illustrate how negative feedback mechanisms can be used to drive within the speed limit.

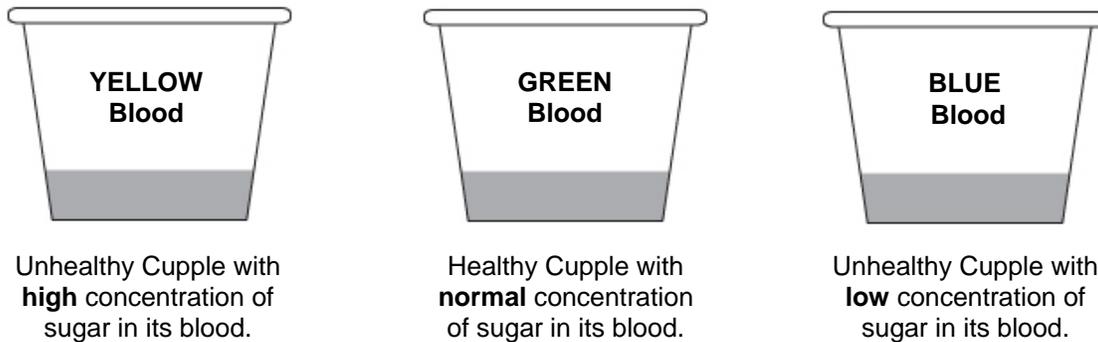
6. Record the arrangement of the cards in the table below:

| Number on Graphic Organizer | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------------------------|----------|----------|----------|----------|----------|----------|
| Letter on Card | C | B | E | D | F | A |

Part 2: Regulating Sugar Concentration in Cupples - a simulation

Cupples are adorable little creatures that spend their lives doing two things, eating and exercising. When Cupples eat, the concentration of sugar in their blood increases. When Cupples exercise, they use food for energy, and the concentration of sugar in their blood decreases.

To maintain homeostasis, Cupples need to keep the concentration of sugar in their blood at a normal level. If they have the normal concentration of sugar in their blood, they will be green.



1. What color is Cupple blood when the concentration of sugar in its blood is at the set point (within the normal range of sugar concentration)?

Green

2. What color is Cupple blood when the concentration of sugar in its blood is too low?

Blue

3. What color is Cupple blood when the concentration of sugar in its blood is too high?

Yellow

4. How does eating affect the concentration of sugar in the blood of a Cupple?

Eating increases the concentration of sugar in the blood.

5. How does exercising affect the concentration of sugar in the blood of a Cupple?

Exercising decreases the concentration of sugar in the blood.

6. Pour the tube of green “Cupple Blood” into the little cup. This cup represents a healthy Cupple who has the normal concentration of sugar in its blood.
7. The Cupple is hungry. Feed the Cupple by using the labeled dropper to add 5 drops of “Sugar” to the cup. Gently swirl the contents of the cup to mix the “Sugar” with the Cupple blood.

- What color change occurs when the Cupple eats?

The blood turns yellow

- What does this color change tell you about the concentration of sugar in the Cupple’s blood?

The concentration of sugar in the blood is too high.

- What response (action) could the Cupple make to restore its blood sugar level to the set point (normal range)?

It could exercise.

- How would this action restore the Cupple’s homeostasis?

When a Cupple exercises, it uses sugar for energy.

8. Now the Cupple exercises. Simulate the effect of this exercise by adding 10 drops of “Exercise” to the cup. Gently swirl the contents of the cup to mix the “Exercise” with the Cupple blood.

- What color change occurs when the Cupple exercises? ***It turns blue***
- What does this color change tell you about the concentration of sugar in the Cupple’s blood?

The concentration of sugar in the blood is too low.

- What response (action) could the Cupple make to restore its blood sugar level to the set point (normal range)?

It could eat.

- How would this action restore the Cupple’s homeostasis?

Eating increases the concentration of sugar in the Cupple’s blood.



9. Whoops! As you can see, the Cupple exercised too much! To maintain homeostasis, the Cupple needs to eat the proper amount of sugar.

10. Count the number of drops of “Sugar” that you need to add to the cup to restore the proper sugar balance. Be sure to gently swirl the contents of the cup to mix the “Sugar” with the Cupple blood after each drop.

- How many drops of “Sugar” were needed to restore homeostasis? 6 – 13
- How did you know when you gave the Cupple enough “Sugar” to restore its homeostasis?

The Cupple’s blood turns green.

- What would happen if you gave the Cupple too much “Sugar”?

The blood would turn yellow.

11. To maintain homeostasis, Cupple use negative feedback mechanisms to detect changes from the set point (normal state), and trigger appropriate responses that return their systems to set point.

- What color represents the set point (normal state) in this simulation?

When the Cupple was green.

- What feedback response was needed to maintain homeostasis when the sugar concentration in Cupple blood went above the set point?

Exercise to reduce the sugar concentration.

- What feedback response was needed to maintain homeostasis when the sugar concentration in the blood went below the set point?

Eating to increase the sugar concentration.

12. Cut along the dotted lines on the green *Regulating the Concentration of Sugar in Cupple Blood* cards in your lab kit.

13. Arrange the cards in the boxes on the *Negative Feedback Graphic Organizer* sheet to illustrate how negative feedback mechanisms can be used to keep the sugar concentration in a Cupple's blood within a normal range.

14. Record the arrangement of the cards in the table below:

| Number on Graphic Organizer | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Letter on Card | <i>E</i> | <i>B</i> | <i>C</i> | <i>A</i> | <i>F</i> | <i>D</i> |

Part 3: Negative Feedback and Body Temperature

Humans use negative feedback mechanisms to maintain homeostasis for many of their body systems. In this part of the lab, you will read about a human negative feedback mechanism that regulates body temperature. You will use the information to arrange cards on the *Negative Feedback Graphic Organizer* sheet.

Body Temperature Homeostasis

Body temperature is normally maintained at about 37°C (98.6°F). If your body temperature increases, receptors in the hypothalamus region of the brain detect the change and send signals to sweat glands causing perspiration (sweating). The hypothalamus signals also cause blood vessels in the skin to dilate (open) to increase blood flow to the body surface. These responses decrease body temperature.

If your body temperature decreases, receptors in the hypothalamus detect the change and send signals to muscles causing shivering which produces heat. The hypothalamus signals also cause blood vessels in the skin to constrict (close) to decrease blood flow to the body surface. These responses increase body temperature.

| Too Hot | Too Cold |
|---|--|
| Blood Vessel Dilation: Blood vessels in skin enlarge to increase blood going to the skin and increase heat loss. | Blood Vessel Constriction: Blood vessels in the skin get smaller to reduce blood going to the skin and decrease heat loss. |
| Perspire: Sweat glands secrete sweat which removes heat when water evaporates. | Shiver: Rapid contraction and relaxation of skeletal muscles. Heat is produced by respiration. “Goosebumps”: Hairs on skin stand up to insulate the body and trap heat. |
| Body Stretches Out: Increases the exposed body surface to release heat. | Body Curls up: Decreases the exposed body surface area to reduce heat loss. |

1. Cut along the dotted lines on the pink *Regulating Body Temperature* sheet in your lab kit.
2. Arrange the cards in the boxes on the *Negative Feedback Graphic Organizer* sheet to illustrate how negative feedback mechanisms keep body temperature constant. Record the arrangement of the cards in the Data Table below:

| Number on Graphic Organizer | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------------------------|----------|----------|----------|----------|----------|----------|
| Letter on Card | A | C | E | F | B | D |

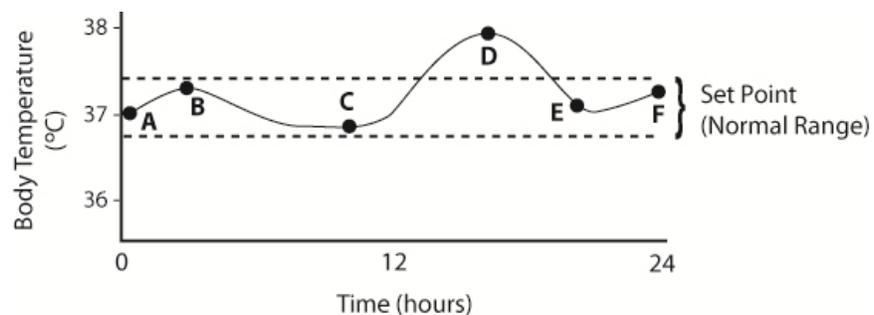
3. What is the set point for body temperature? *37° C*
4. If this negative feedback mechanism detects an increase in body temperature (above the set point), what response should be triggered to maintain homeostasis?

Sweating and dilation of blood vessels in the skin to lower body temperature.

5. If this negative feedback mechanism detects a decrease in body temperature (below the set point), what response should be triggered to maintain homeostasis?

Shivering and constriction of blood vessels in the skin to increase body temperature.

The graph below shows evidence of disease in the human body. Base your answer to questions 6 and 7 on the information in the graph.



6. A disruption in homeostasis is indicated by temperature change between points
 1. A and B
 2. B and C
 - 3. C and D**
 4. E and F

7. The action of a feedback mechanism is indicated by temperature change between points
 1. A and B
 2. B and C
 3. C and D
 - 4. D and E**

Part 4: Negative Feedback and Blood Glucose

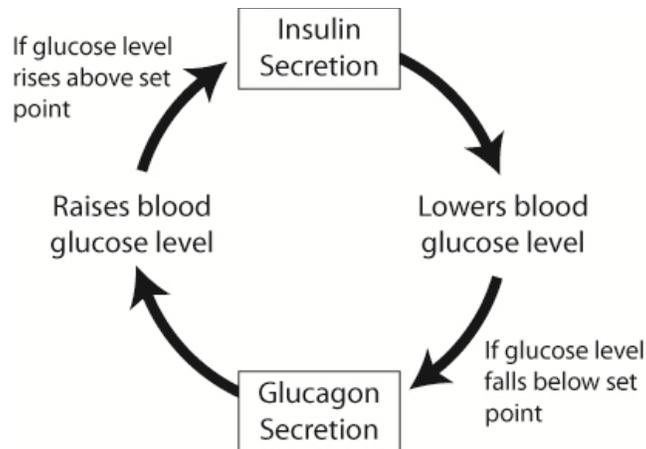
Humans use negative feedback mechanisms to maintain homeostasis for many of their body systems. In this part of the lab, you will read about a human negative feedback mechanism that regulates glucose (sugar) concentration in the blood. You will use this information to answer questions about how this feedback mechanism maintains homeostasis.

Blood Glucose Homeostasis

The concentration of glucose in the blood affects every cell in the body. Therefore, its concentration is strictly controlled within the range 80-100 mg of glucose per 100 ml of blood. Very low levels of blood glucose or very high levels of blood glucose are both serious conditions and can lead to death.

Blood glucose concentration is controlled by the pancreas. The pancreas has glucose receptor cells, which monitor the concentration of glucose in the blood, and it also has endocrine cells which secrete the hormones **insulin** and **glucagon**. These two hormones have opposite effects on blood glucose

Glucagon stimulates the release of stored glucose from the liver which increases blood glucose levels. Insulin stimulates the uptake of glucose by cells which decreases blood glucose levels.



After a meal, glucose is absorbed from the digestive tract and glucose concentration in blood increases. This increase is detected by the pancreas, which responds by secreting insulin. Insulin causes glucose to be taken up by the body cells. This reduces blood glucose, which causes the pancreas to stop secreting insulin.

If the glucose level decreases too much, the pancreas detects this change and responds by secreting the hormone glucagon. Glucagon causes the release of stored glucose from the liver. This increases blood glucose, which causes the pancreas to stop producing glucagon.

1. What is the set point (normal level) for blood glucose? **80-100 mg of glucose per 100 ml of blood.**
2. What organ detects above or below normal blood glucose concentrations? **The pancreas**
3. If blood glucose levels are too high, what hormone will this organ secrete? **Insulin**
4. If blood glucose levels are too low, what hormone will this organ secrete? **Glucagon**
5. How does insulin cause the blood glucose level to decrease?

Insulin causes glucose to be taken up by the body cells. This reduces blood glucose, which causes the pancreas to stop secreting insulin.

6. How does glucagon cause the blood glucose level to increase?

Glucagon causes the release of stored glucose from the liver.

7. People who have Type 1 Diabetes do not make enough insulin. What effect would this have on their blood glucose level?

Their blood sugar would increase above the normal concentration.

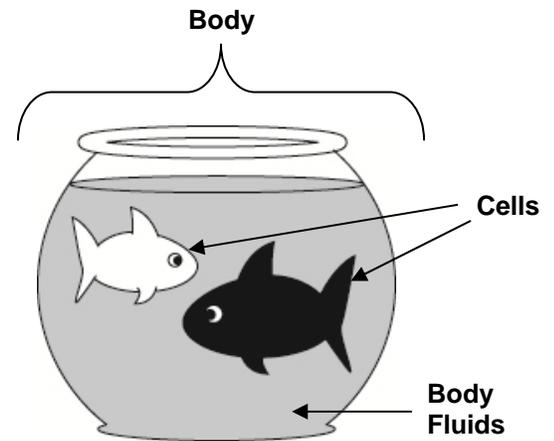
8. If their blood glucose level is too high, what two actions could people with diabetes take to maintain homeostasis?

***Get an injection of insulin
Reduce the amount of food they eat
Exercise***

Part 5: A Fishbowl Analogy for Homeostasis

Maintaining homeostasis in the body is similar to keeping conditions in a fishbowl balanced.

- The contents of a fishbowl represent a multicellular body. Fish represent the cells of a multicellular body.
- For fish to survive, the internal environment (fluids) in the fishbowl must be maintained to provide the proper temperature and the proper levels of nutrients, oxygen, carbon dioxide, and waste.
- Devices such as heaters/coolers, automatic feeders, air bubblers and filters can be used to maintain the proper internal environment.



Use the words from these lists of human body parts and functions to complete the Fishbowl Analogy Table below:

- Human Body:**
- Body fluid
 - Digestive tract
 - Kidneys
 - Lungs
 - Muscles
 - Skin

- Functions:**
- Barrier
 - Internal environment
 - Maintain constant temperature
 - Maintain food level
 - Excrete nitrogen wastes
 - Maintain oxygen
 - Homeostasis

Fishbowl Analogy Table:

| Fishbowl | Human Body | Functions |
|-----------------------------|------------------------|--------------------------------------|
| Fish | Cells | Need to stay alive |
| Glass bowl | Skin | Barrier |
| Water | Body fluid | Internal environment |
| Air pump | Lungs | Maintain oxygen level |
| Filter | Kidneys | Remove nitrogen wastes |
| Heater | Muscles | Maintain constant temperature |
| Feeder | Digestive tract | Maintain food level |
| Everything working together | | Homeostasis |

Adapted with permission from Homeostasis, © Kevin Patton, <http://london.com>

MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name (as printed on the label): "Cupple Blood"

Product identity: 0.05% bromothymol blue solution

Distributor: Science Take-Out, LLC. PO Box 205, Pittsford, NY 14534

Telephone number for information: (585)764-5400 Medical emergency phone number (Chemtrec): (800) 424-9300

Date of this MSDS: 5/21/10

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredients | CAS Numbers | % Weight/Volume | TLV Units |
|------------------------------|-------------|-----------------|------------------|
| Bromothymol blue sodium salt | 34722-90-2 | 0.01% | None established |
| Water | 7732-18-5 | 99.99% | None established |

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Do not ingest. Avoid skin and eye contact. Avoid exposure to vapor or mists.

Potential Health Effects EYES: May cause irritation. SKIN: May cause slight irritation. INHALATION: n/a
INGESTION: May cause gastrointestinal discomfort

4. FIRST AID MEASURES

EYES - Flush with water for at least 15 minutes, raising and lowering eyelids occasionally. Get medical attention if irritation persists.

SKIN - Thoroughly wash exposed area for at least 15 minutes. Remove contaminated clothing. Launder contaminated clothing before reuse. Get medical attention if irritation persists.

INGESTION - Do not induce vomiting. If swallowed, if conscious, give plenty of water immediately and call a physician or poison control center. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

NFPA Rating: Health: 1 (slight) Fire: 0 Reactivity: 0

Extinguisher Media: Any means suitable for extinguishing surrounding fire

Firefighting Procedures: Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus.

Unusual Fire and Explosion Hazards: None

6. SPILL OR LEAK PROCEDURES

Ventilate area of spill. Clean-up personnel should wear proper protective equipment and clothing. Mop up, or absorb material with suitable absorbent and containerize for disposal.

7. HANDLING AND STORAGE

Store in a cool dry place. Handle using safe laboratory practices.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection: None required

Ventilation: Local Exhaust: Preferred

Protective Gloves: Natural rubber, Neoprene, PVC or equivalent.

Eye Protection: Splash proof chemical safety goggles should be worn.

Other Protective Clothing or Equipment: Lab coat, apron, eye wash, safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Melting Point: <2°C

Vapor Pressure: Ca 50 @ 20°C

Specific Gravity (H₂O=1): ~1

Evaporation Rate: ~ same as water

Appearance and Odor: Green liquid

Boiling Point: >98°C

Vapor Density: ~ same as water

Percent Volatile by Volume: information not available

Solubility in Water: soluble

10. STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid: none known

Hazardous Decomposition Products: none

Reactive under what conditions: none known

11. TOXICOLOGICAL INFORMATION

| Toxicity (rat) LD ₅₀ |
|---|
| Acute oral toxicity = information not available |
| Acute toxicity from vapor = information not available |

Effects of Overexposure:

Acute: Irritation of eyes/skin

Chronic: Irritation of eyes/skin

Target Organs: Eyes, skin.

Primary Route(s) of Entry: Ingestion

12. ECOLOGICAL INFORMATION

No data available

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods: Dispose in accordance with all applicable Federal, State and Local regulations.

Always contact a permitted waste disposer (TSD) to assure compliance.

14. TRANSPORTATION INFORMATION

No data available

15. REGULATORY INFORMATION

No data available

16. ADDITIONAL INFORMATION

The information provided in this Material Safety Data Sheet represents data from the manufacturer and/or vendor and is accurate to the best of our knowledge. By providing this information, Science Take-Out LLC makes no guarantee or warranty, expressed or implied, concerning the safe use, storage, handling, precautions, and/or disposal of the products covered or the accuracy of the information contained in this fact sheet. It is the responsibility of the user to comply with local, state, and federal laws and regulations concerning the safe use, storage, handling, precautions, and/or disposal of products covered in this fact sheet.

MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name (as printed on the label): "Food"

Product identity: 0.005 M Hydrochloric Acid solution (HCl)

Distributor: Science Take-Out, LLC. PO Box 205, Pittsford, NY 14534

Telephone number for information: (585)764-5400 Medical emergency phone number (Chemtrec): (800) 424-9300

Date of this MSDS: 5/25/10

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredients | CAS Numbers | % Weight/Volume | TLV Units |
|-------------------|-------------|-----------------|------------------|
| Hydrochloric Acid | 7647-01-0 | <0.005% | None established |
| Water | 7732-18-5 | >99.995% | None established |

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Do not ingest. Avoid skin and eye contact. Avoid exposure to vapor or mists.

Potential Health Effects EYES: Causes irritation. SKIN: May cause slight irritation. INHALATION: n/a
INGESTION: May cause gastrointestinal discomfort

4. FIRST AID MEASURES

EYES - Flush with water for at least 15 minutes, raising and lowering eyelids occasionally. Get medical attention if irritation persists.

SKIN - Thoroughly wash exposed area for at least 15 minutes. Remove contaminated clothing. Launder contaminated clothing before reuse. Get medical attention if irritation persists.

INGESTION - Do not induce vomiting. If swallowed, if conscious, give plenty of water immediately and call a physician or poison control center. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

NFPA Rating: Health: 1 (slight) Fire: 0 Reactivity: 0

Noncombustible solution. When heated to decomposition, emits acrid fumes.

Extinguisher Media: Use foam or dry chemical to extinguish fire

Firefighting Procedures: Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus.

Unusual Fire and Explosion Hazards: None

6. SPILL OR LEAK PROCEDURES

Ventilate area of spill. Clean-up personnel should wear proper protective equipment and clothing. Mop up, or absorb material with suitable absorbent and containerize for disposal.

7. HANDLING AND STORAGE

Store in a cool dry place. Handle using safe laboratory practices.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection: None required

Ventilation: Local Exhaust: Preferred

Protective Gloves: Natural rubber, Neoprene, PVC or equivalent.

Eye Protection: Splash proof chemical safety goggles should be worn.

Other Protective Clothing or Equipment: Lab coat, apron, eye wash, safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Melting Point: 0°C

Vapor Pressure: 14 @ 20°C

Specific Gravity (H₂O=1): ~1

Evaporation Rate: ~ same as water

Appearance and Odor: clear colorless liquid

Boiling Point: 100°C

Vapor Density: ~ same as water

Percent Volatile by Volume: information not available

Solubility in Water: soluble

10. STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid (for more concentrated HCl solution): Alkalis, strong bases, metals, amines, carbonates, metal oxides, cyanides, sulfides, sulfites and formaldehyde

Hazardous Decomposition Products: none

Reactive under what conditions: none known

11. TOXICOLOGICAL INFORMATION (*information for 12M HCl*)

| Toxicity (rat) LD ₅₀ |
|---|
| Acute oral toxicity = 900 mg/kg |
| Acute toxicity from vapor = information not available |

Effects of Overexposure:

Acute: Irritation of eyes/skin

Chronic: Irritation of eyes/skin

Target Organs: Eyes, skin, respiratory system

Primary Route(s) of Entry: Ingestion

12. ECOLOGICAL INFORMATION

No data available for 0.005% HCl

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods: Dispose in accordance with all applicable Federal, State and Local regulations. Always contact a permitted waste disposer (TSD) to assure compliance.

14. TRANSPORTATION INFORMATION

No data available for 0.005% HCl

15. REGULATORY INFORMATION

No data available for 0.005% HCl

16. ADDITIONAL INFORMATION

The information provided in this Material Safety Data Sheet represents data from the manufacturer and/or vendor and is accurate to the best of our knowledge. By providing this information, Science Take-Out LLC makes no guarantee or warranty, expressed or implied, concerning the safe use, storage, handling, precautions, and/or disposal of the products covered or the accuracy of the information contained in this fact sheet. It is the responsibility of the user to comply with local, state, and federal laws and regulations concerning the safe use, storage, handling, precautions, and/or disposal of products covered in this fact sheet.

MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name (as printed on the label): "Exercise"

Product identity: 0.005 M Sodium Hydroxide solution (NaOH)

Distributor: Science Take-Out, LLC. PO Box 205, Pittsford, NY 14534

Telephone number for information: (585)764-5400 Medical emergency phone number (Chemtrec): (800) 424-9300

Date of this MSDS: 5/25/10

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredients | CAS Numbers | % Weight/Volume | TLV Units |
|------------------|-------------|-----------------|------------------|
| Sodium Hydroxide | 7647-01-0 | <0.005% | None established |
| Water | 7732-18-5 | >99.995% | None established |

3. HAZARDS IDENTIFICATION

| |
|---------------------------|
| EMERGENCY OVERVIEW |
|---------------------------|

Do not ingest. Avoid skin and eye contact. Avoid exposure to vapor or mists.

Potential Health Effects EYES: Causes irritation. SKIN: May cause slight irritation. INHALATION: n/a
INGESTION: May cause gastrointestinal discomfort

4. FIRST AID MEASURES

EYES - Flush with water for at least 15 minutes, raising and lowering eyelids occasionally. Get medical attention if irritation persists.

SKIN - Thoroughly wash exposed area for at least 15 minutes. Remove contaminated clothing. Launder contaminated clothing before reuse. Get medical attention if irritation persists.

INGESTION - Do not induce vomiting. If swallowed, if conscious, give plenty of water immediately and call a physician or poison control center. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

NFPA Rating: Health: 1 (slight) Fire: 0 Reactivity: 0

Noncombustible solution. When heated to decomposition, emits acrid fumes.

Extinguisher Media: Use foam or dry chemical to extinguish fire

Firefighting Procedures: Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus.

Unusual Fire and Explosion Hazards: None

6. SPILL OR LEAK PROCEDURES

Ventilate area of spill. Clean-up personnel should wear proper protective equipment and clothing. Mop up, or absorb material with suitable absorbent and containerize for disposal.

7. HANDLING AND STORAGE

Store in a cool dry place. Handle using safe laboratory practices.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection: None required
Ventilation: Local Exhaust: Preferred
Protective Gloves: Natural rubber, Neoprene, PVC or equivalent.
Eye Protection: Splash proof chemical safety goggles should be worn.
Other Protective Clothing or Equipment: Lab coat, apron, eye wash, safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Melting Point: 0°C
Vapor Pressure: N/A
Specific Gravity (H₂O=1): ~1
Evaporation Rate: ~ same as water
Appearance and Odor: clear colorless liquid

Boiling Point: 100°C
Vapor Density: ~ same as water
Percent Volatile by Volume: information not available
Solubility in Water: soluble

10. STABILITY AND REACTIVITY

Stability: Stable
Materials to Avoid (for more concentrated NaOH solution): Acids, organic compounds, metals
Hazardous Decomposition Products: none
Reactive under what conditions: none known

11. TOXICOLOGICAL INFORMATION (for 12M HCl)

| Toxicity (rat) LD ₅₀ |
|---|
| Acute oral toxicity = information not available |
| Acute toxicity from vapor = information not available |

Effects of Overexposure:
Acute: Irritation of eyes/skin
Chronic: Irritation of eyes/skin
Target Organs: Eyes, skin, respiratory system
Primary Route(s) of Entry: Ingestion

12. ECOLOGICAL INFORMATION information not available

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods: Dispose in accordance with all applicable Federal, State and Local regulations.
Always contact a permitted waste disposer (TSD) to assure compliance.

14. TRANSPORTATION INFORMATION No data available for 0.005% NaOH

15. REGULATORY INFORMATION No data available for 0.005% NaOH

16. ADDITIONAL INFORMATION

The information provided in this Material Safety Data Sheet represents data from the manufacturer and/or vendor and is accurate to the best of our knowledge. By providing this information, Science Take-Out LLC makes no guarantee or warranty, expressed or implied, concerning the safe use, storage, handling, precautions, and/or disposal of the products covered or the accuracy of the information contained in this fact sheet. It is the responsibility of the user to comply with local, state, and federal laws and regulations concerning the safe use, storage, handling, precautions, and/or disposal of products covered in this fact sheet.