
CITY OF
WOODLAND
CALIFORNIA

# Sort It Out!

## K-12 Lessons on Rethinking Waste in Yolo County

Funded By CalRecycle

# Sort It Out!

## K-12 Lessons on Rethinking Waste in Yolo County

CITY OF
WOODLAND
CALIFORNIA

# Created for City of Woodland and Yolo County K-12 educators and students with support from:

**Sort It Out:** *K-12 Lessons on Rethinking Waste in Yolo County*



City of Woodland Environmental Services supports community stewardship of natural resources and the city's compliance with federal, state, and local environmental laws and regulations. Environmental Services educates the public about environmental regulatory compliance and promotes solid waste reduction and recycling, water and energy conservation, and enhanced stormwater quality. Learn more at EnviroWoodland.org.

**City of Woodland**
**Environmental Services**
300 First Street
Woodland, CA 95695
(530) 661-5800
EnviroWoodland@cityofwoodland.gov

*This resource was written and created by Blueblossom Consulting on behalf of the City of Woodland using CalRecycle grant funds to promote beverage container recycling, organic waste diversion, and waste reduction in Woodland schools.*

*Printed on recycled paper in the United States of America.*

# What's Inside?


Dear Educator,

Thank you for your dedication to shaping environmentally conscious learners. ***Sort It Out: K-12 Lessons on Rethinking Waste in Yolo County*** offers hands-on, engaging lessons on locally relevant recycling practices and beverage container programs, organic waste, and waste reduction. These activities equip students to make informed choices, reduce their environmental impact, and contribute to a sustainable future.

This guide goes beyond teaching where waste comes from and where it goes. It connects to real-world applications of the Next Generation Science Standards (NGSS) by integrating systems thinking, energy flow, and an evaluation of human impacts on the planet. Through STEAM-focused experiments, data collection, and creative challenges, students build critical thinking, argumentation, and problem-solving skills.

Designed for learners residing in Yolo County, these lessons highlight local waste management practices, such as California Redemption Value (CRV) programs and material recovery. By examining these systems, students see how their actions impact their local environment and learn ways to create meaningful change in their schools and communities, and beyond.

We hope these activities inspire you to nurture the next generation of environmental leaders. If you have questions or feedback, please contact us at EnviroWoodland@cityofwoodland.gov.

*Let's reduce, reuse, and recycle for a brighter tomorrow!*

Sincerely,

**Allison Martin**
Blueblossom Consulting

**Rosie Ledesma**
City of Woodland

# Navigating This Resource

***Sort It Out! K-12 Lessons on Rethinking Waste in Yolo County*** makes recycling lesson planning and implementation effortless.


## Units

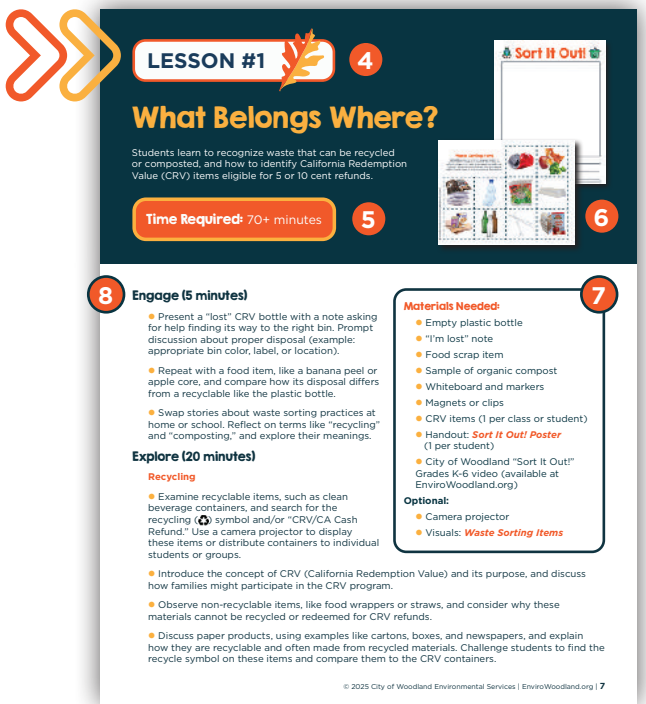
The curriculum is divided into four grade-band units: K-2, 3-5, 6-8, and 9-12.

1. Intended grade level and unit theme searchable in the Table of Contents.
2. A description of the unit goals and a summary of the hands-on activities used to achieve them.
3. Grade appropriate learning objectives (left box) and any pre-requisites necessary for students to successfully complete the unit (right box).

## Lessons

Each unit includes one to two hands on lessons structured using the 5E Instructional Model: Engage, Explore, Explain, Expand, and Evaluate.

4. Lesson number and title searchable in the Table of Contents.
5. Minimum time recommended to complete all 5E activities; adjust accordingly based on teacher and student needs and interests.
6. Examples of which handouts and visuals are offered for each lesson.
7. Materials required and recommended to complete all activities.
8. Complete lesson plan. California curriculum standards listed at the end.



# Things To Know

## Introduction

Effective waste management is essential to creating a sustainable and healthy community. Across Yolo County, a combination of city and county staff, programs, and facilities work to minimize landfill waste, promote recycling, and ensure environmentally responsible practices.

## Waste Laws in California

California law and local ordinances require the separation of recyclables and organic waste from the landfill-bound waste stream. These laws apply to everyone: residents, businesses, restaurants, hospitals, hotels, government buildings, schools, and more.

To support proper waste sorting, a standardized color-coded bin system is used:

- **Blue Bins:** Recyclables like plastic #1-7, aluminum cans, other metals, paper, cardboard, and glass.
- **Green Bins:** Organic waste such as food scraps, food-soiled paper, and yard trimmings for composting.
- **Black/Grey Bins:** Waste that cannot be recycled or composted.


School waste sorting program at Science and Technology Academy Knights Landing, a Woodland Joint Unified School District charter school.

These regulations help conserve resources, extend landfill capacity, and mitigate climate change by reducing carbon dioxide and methane gas emissions.

## Waste Management in Yolo County

Yolo County and its city jurisdictions use a comprehensive approach to waste management that prioritizes waste reduction, recycling, and composting to minimize landfill use and protect the environment.

The Yolo County Central Landfill is the primary site for local waste disposal and operates under strict environmental regulations to ensure safe and efficient waste processing. The cities and county support proper waste diversion through programs such as curbside recycling, organics collection and commercial composting, and California Redemption Value (CRV) recycling programs.

Landfill operation at the Yolo County Central Landfill (Woodland, CA).

CRV programs and Materials Recovery Facilities (MRFs) play a vital role in sorting recyclables from other waste streams, ensuring that recoverable materials are processed into new products instead of landfilled. Educators can help students understand the importance of these systems by connecting classroom activities to real-world waste management practices here in Yolo County and around the world.

## California Redemption Value (CRV) Recycling

The CRV program is a statewide deposit-refund system where consumers pay 5 to 25 cents per beverage container at purchase and get a refund when recycling the container at a CRV recycling center. The refund system encourages the recycling of aluminum, plastic, and glass beverage containers.

Educators can teach students to spot CRV containers by looking for the “CA Cash Refund” or “CRV” logo. Activities like collecting and sorting CRV containers at home or at school can help students experience the environmental and economic benefits of recycling beverage containers.


CA CRV logo seen on the top of an aluminum can.

## Material Recovery Facilities (MRFs)

MRFs sort mixed recyclables into categories like paper, plastics, metals, and glass using a combination of manual labor and advanced technology:

- **Optical Sorters:** Use light and imaging to identify glass by color and plastics by resin type.
- **Magnets and Eddy Currents:** Separate ferrous (iron-based) and non-ferrous metals.
- **Air Jets:** Blast materials into designated bins or onto conveyor belts.

Learning how MRFs work help students understand the importance of proper sorting to minimize contamination.

Workers at a MRF remove recyclable plastic from non-recyclable bags.

## Waste Reduction Strategies

Reducing waste begins with the **Three Rs**:

- **Reduce:** Buy fewer single-use items to save resources and generate less waste in the long-run.
- **Reuse:** Find new ways to extend the life or usefulness of existing materials.
- **Recycle:** Turn waste into new products to save raw materials and energy.

**Upcycling** is also a great way to reduce waste, and is the ultimate STEAM experiment! Through upcycling, students can repurpose waste into useful or artistic creations.


Students work on a poster promoting the Three Rs - and more!

## Conclusion

City and countywide, our waste management programs offer practical and impactful ways to cut landfill waste and conserve resources. By teaching students about recycling CRV containers and other recyclable products,  composting, and creative waste solutions, educators can instill lifelong environmental responsibility - helping build a cleaner, greener future for all.

GRADES
K-2

# Sort It Out 101

**Introduce students to waste management through hands-on activities like sorting recyclables and exploring waste life cycles.**

Students identify CRV items, learn about recycling, and explore responsible waste disposal. Through teaching others and reusing materials in a life cycle project, they develop critical thinking and environmental stewardship skills.

**Students will be able to:**

- Identify and properly sort recyclable and compostable waste from trash
- Understand and utilize the California Redemption Value (CRV) program
- Describe the life cycles of recyclable and compostable materials
- Be a responsible community member by managing waste properly and inspiring others to do the same

**Unit Pre-Requisites:**

- Ability to identify and name basic colors, symbols, and letters
- Basic sorting skills and the ability to group objects by type, size, or other characteristics
- Familiarity with the types of waste encountered in daily life
- Introductory knowledge of terms like “recycling,” “composting,” and “trash”

# LESSON #1

# What Belongs Where?

Students learn to recognize waste that can be recycled or composted, and how to identify California Redemption Value (CRV) items eligible for 5 or 10 cent refunds.

**Time Required:** 70+ minutes


## Engage (5 minutes)

- Present a "lost" CRV bottle with a note asking for help finding its way to the right bin. Prompt discussion about proper disposal (example: appropriate bin color, label, or location).
- Repeat with a food item, like a banana peel or apple core, and compare how its disposal differs from a recyclable like the plastic bottle.
- Swap stories about waste sorting practices at home or school. Reflect on terms like "recycling" and "composting," and explore their meanings.

## Explore (20 minutes)

### Recycling

- Examine recyclable items, such as clean beverage containers, and search for the recycling (♺) symbol and/or "CRV/CA Cash Refund." Use a camera projector to display these items or distribute containers to individual students or groups.
- Introduce the concept of CRV (California Redemption Value) and its purpose, and discuss how families might participate in the CRV program.
- Observe non-recyclable items, like food wrappers or straws, and consider why these materials cannot be recycled or redeemed for CRV refunds.
- Discuss paper products, using examples like cartons, boxes, and newspapers, and explain how they are recyclable and often made from recycled materials. Challenge students to find the recycle symbol on these items and compare them to the CRV containers.

### Materials Needed:

- Empty plastic bottle
- "I'm lost" note
- Food scrap item
- Sample of organic compost
- Whiteboard and markers
- Magnets or clips
- CRV items (1 per class or student)
- Handout: ***Sort It Out! Poster*** (1 per student)
- City of Woodland "Sort It Out!" Grades K-6 video (available at EnviroWoodland.org)

**Optional:**

- Camera projector
- Visuals: ***Waste Sorting Items***

### Organic Waste

- Explore organic compost through observation (look, smell, touch), and share discoveries and connections (use prompts like *I notice, I wonder, It reminds me of*).
- Discuss how food scraps and plant material transform into compost, supporting soil and growth, while emphasizing the wasted opportunity when food is thrown in the trash.
- Reflect on which items from the current school lunch menu could be composted.
- Compare compostable materials to recyclable ones to think critically about why some items, like plastic bottles or aluminum cans, cannot be composted and should be recycled instead.

## Explain (20 minutes)

- Play the City of Woodland "Sort It Out!" K-6 video (at EnviroWoodland.org).
- Set up three bins with color-coded labels (Recycling = **blue**, Compost = **green**, Trash = **black or grey**). Give each student a clean waste item to sort and have them explain their choice.
- Alternatively, use the printed ***Waste Sorting Items*** visuals and have students sort those into the correct bins.

## Expand (20+ minutes)

- Prior to the lesson, coordinate with custodial staff to set aside trash bags for student examination. Keep items in the bags or empty onto a tarp.
- Observe the bags or bins, identify and count sorting mistakes, and re-sort items properly while wearing gloves and/or masks and aprons for personal safety and hygiene.
- Collect reusable or recyclable items for future projects, such as milk cartons for plant experiments, and CRV containers for fundraising activities.
- Personalize the ***Sort It Out! Poster*** handout with colors and messages to teach others about proper waste sorting. Display completed posters in the cafeteria or classroom.

## Evaluate (5 minutes)

- Students share one thing they learned about CRV recycling through a drawing or sentence (example: "Recycling bottles helps make new things") on the poster handout.

A school trash bin contains juice boxes and CRV beverage containers that should have been recycled.

### California Curriculum Connections:

**Science:** Communicate solutions that reduce human impact on the environment

**Language Arts:** Read, write, and discuss recycling and sharing ideas with others

**Math:** Practice counting and addition and describe materials by shape or attribute

**Social Studies:** View recycling as one way to be a good citizen and make a difference

# Waste Sorting Items

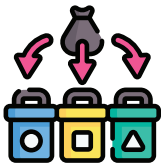
**Instructions:** Copy or print one page per student or group. Print on cardstock or laminate after cutting for more durability. Cut out each object along the dashed line. Distribute sets to students to practice their waste sorting skills without the mess of using real waste in the classroom.





# Sort It Out!



**By:** _____

*I learned that* _____

_____

# LESSON #2

# Life Cycles in Recycling

Students learn about the life cycles of waste and how recycling and composting saves resources.



**Time Required:** 70+ minutes

## Engage (15 minutes)

- Present a CRV aluminum can and a plastic bottle. Prompt discussion about the origins of these items, how they are used, and what happens to them when they are empty.
- Introduce the concept of a life cycle as a process of how something begins, changes, and starts again (example: a butterfly's life cycle). Use examples or models of plant and animal life cycles to help explain.

## Explore (20 minutes)

- Use magnets or clips to randomly attach cutouts from the ***Life Cycle of an Aluminum Can*** visual to a whiteboard.
- Review the pictures and descriptions with students, highlighting the CRV/CA Cash Refund logos or symbols and discussing what a CRV beverage container is.
- Invite students to arrange the images into a life cycle on the board. Help them add arrows to show the process of recycling an aluminum can. Encourage peer feedback and discussion between each step of the life cycle.
- Repeat these steps with the remaining ***Life Cycles*** visuals, either as a whole class, as groups, or as individuals (provide groups or individuals with their own copies of the visuals).
- **Optional:** Brainstorm how each recyclable can also be reused or upcycled. Record student ideas for a separate lesson on the "Three R's" and upcycling.

## Materials Needed:

- Clean and empty CRV containers (1 per class or student)
- 1-2 non-recyclable items
- Plant or animal life cycle diagrams
- Handout: ***Life Cycles in Recycling*** (1 per student)
- Visuals: ***Life Cycle of a Recycled Aluminum Can, Plastic Bottle, Glass Bottle, Food Scrap***
- Whiteboard, markers, magnets or clips

**Optional:**

- Clean milk cartons with gable tops removed (1 per student)
- Compost and/or potting soil
- Seeds (e.g., legumes)
- Spray bottles with water
- Student name labels

## Explain (10 minutes)

- Students summarize a recyclable's life cycle in question #1 of the ***Life Cycles in Recycling*** handout. Focus on the start and end points, as well as transformations. Encourage pairs or small groups to share and compare their thoughts.

- Introduce non-recyclable items, such as food packaging and straws, and ask what happens to them in landfills. Use a picture of the Yolo County Central Landfill (available through an online search) to illustrate how waste is buried and can never be used again. Ask if a recyclable like a beverage container can be used again if it is sent to the landfill instead of recycled.

- On the handout, students contrast the first life cycle with the life cycle of a recyclable item if it ends up in a landfill.

## Expand (20+ minutes; 7+ days for experiment)

- Define reuse as "using something again instead of throwing it away or recycling it" and provide or ask for examples that illustrate the concept (examples: melting broken crayons together to make new crayons, sewing an old t-shirt into a shopping bag, using a plastic spork and craft supplies to make a puppet; backpacks, lunchpails, and clothes are also examples of things students reuse every day).

- Reuse school milk cartons for a plant life cycle project. Prepare each carton by rinsing and drying it, and then cut off the gable top to leave an open rectangular base.

- Demonstrate how to add compost, plant a seed (example: legume), and mist the soil. Allow students to set up their own project and make some predictions about their plant's life cycle, growth rate, or watering needs.

- Have students write their names and the seed type on a popsicle stick and insert the stick into the soil.

- Place the cartons on a tray in sunlight or under lamps for ongoing observation, misting as needed. Use this activity as a bridge to lessons on plant and animal life cycles, connecting back to the recycling life cycle lesson.


An example of an empty milk carton being used as a seed starter or planter.

## Evaluate (5 minutes)

- Students update their handout to indicate what they've learned about recyclable life cycles and reusing waste. Invite students to share their conclusions or questions with the class.

### California Curriculum Connections:

**Science:** Explore recycling as a life cycle system and observe plant growth cycles

**Language Arts:** Listening, drawing, and writing about recycling

**Math:** Sequencing steps in a flow chart and measuring plant growth

**Social Studies:** View recycling as one way to be a good citizen and make a difference in the community

# Life Cycle of a Recycled Aluminum Can

**Instructions:** Use this page or make a copy. Print on cardstock or laminate for more durability. Cut out each object along the dashed line. Use magnets to hang each image, in random order, on a whiteboard, display with a camera projector, or have students work on them at their desk. Have students organize the can's "life cycle" in order and add arrows. Short descriptions for each stage are provided on the back of each image.

**1: Empty**

**2: Recycle**

**3: Crush**

**4: Shred**

**5: Melt & Mold**

**6: Roll**

**7: New Can**

1: Empty

No more drink inside!

2: Recycle

Recycle in a blue bin or CRV recycle center.

3: Crush

Clean and crush into a big block.

4: Shred

Shred the block into tiny pieces of aluminum.

5: Melt & Mold

Melt into a liquid and cool into a block (ingot).

6: Roll

Roll into sheets for cans, foil, planes, or car parts.

7: New Can

Make into a new can and fill with a drink.

# Life Cycle of a Recycled Plastic Bottle

**Instructions:** Use this page or make a copy. Print on cardstock or laminate for more durability. Cut out each object along the dashed line. Use magnets to hang each image, in random order, on a whiteboard, display with a camera projector, or have students work on them at their desk. Have students organize the can's "life cycle" in order and add arrows. Short descriptions for each stage are provided on the back of each image.

## 1: Empty

## 2: Recycle

## 3: Shred & Wash

## 4: Pellet

## 5: Heat & Shape

## 6a: New Plastic Bottle

## 6b: New Plastic Item

| 1: Empty | 2: Recycle | 3: Shred & Wash | 4: Pellet |
| --- | --- | --- | --- |
| No more drink inside! | Recycle in a blue bin or CRV recycle center. | Shred into flakes and wash off the labels. | Melt flakes into pellets (nurdles) and send them to factories. |

| 5: Heat & Shape | 6a: New Plastic Bottle | 6b: New Plastic Item |
| --- | --- | --- |
| Heat and stretch nurdles into a bottle shape, or into something else. | Make into a new bottle and fill with a drink. | Make into a new plastic item. |

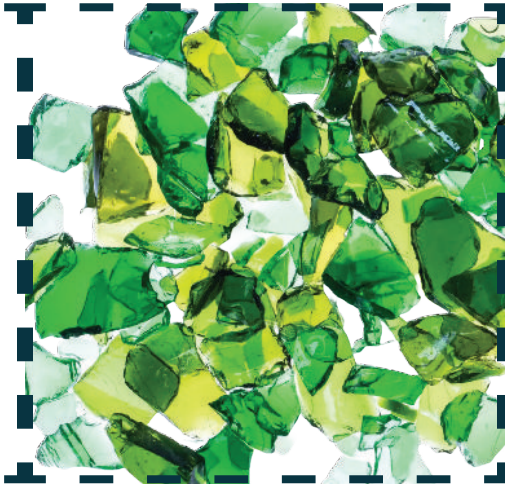
# Life Cycle of Recycled Glass Bottle

**Instructions:** Use this page or make a copy. Print on cardstock or laminate for more durability. Cut out each object along the dashed line. Use magnets to hang each image, in random order, on a whiteboard, display with a camera projector, or have students work on them at their desk. Have students organize the can's "life cycle" in order and add arrows. Short descriptions for each stage are provided on the back of each image.

## 1: Empty

## 2: Recycle

## 3a: Sort



## 3b: Crush

## 4: Melt and Mold

## 5: New Glass Bottle

1: Empty

No more drink inside!

2: Recycle

Recycle in a blue bin or CRV recycle center.

3a: Sort

Sort by color now and crush into tiny pieces later.

3b: Crush

Crush into tiny pieces now and sort by color later.

4: Melt and Mold

Melt cullets into liquid and cool into bottle shapes.

5: New Glass Bottle

Make into a new bottle and fill with a drink.

# Life Cycle of Composted Food

**Instructions:** Use this page or make a copy. Print on cardstock or laminate for more durability. Cut out each object along the dashed line. Use magnets to hang each image, in random order, on a whiteboard, display with a camera projector, or have students work on them at their desk. Have students organize the can's "life cycle" in order and add arrows. Short descriptions for each stage are provided on the back of each image.

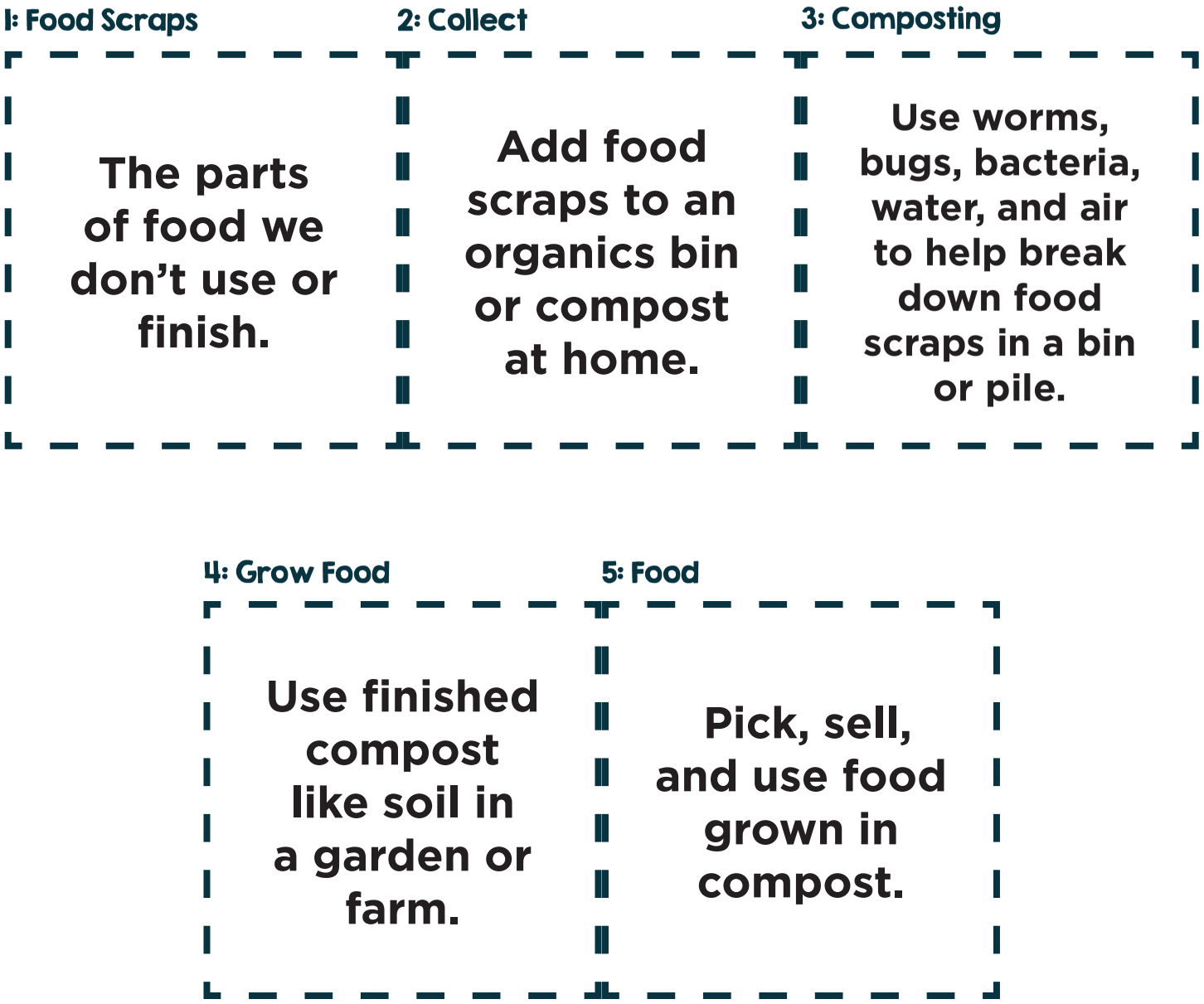
**1: Food Scraps**

**2: Collect**


**3: Composting**

**4: Grow Food**

**5: Food**


1: Food Scraps
The parts of food we don't use or finish.
2: Collect
Add food scraps to an organics bin or compost at home.
3: Composting
Use worms, bugs, bacteria, water, and air to help break down food scraps in a bin or pile.
4: Grow Food
Use finished compost like soil in a garden or farm.
5: Food
Pick, sell, and use food grown in compost.

# Life Cycles in Recycling

**Name:** _____ **Teacher:** _____ **Date:** _____

A life cycle shows us how a thing begins, changes, and ends:

*A frog starts as an egg, hatches into a tadpole, grows legs, and becomes a frog that lays eggs.*
*A flower starts as a seed, grows into a plant, makes flowers, and then makes new seeds!*

Cans, bottles, and food can also go through a life cycle,
but only when we recycle or compost them.

## 1. Recycle Life Cycle

***Draw and write what happens to a can or bottle when you recycle it.*** What is its life cycle?

## 2. Landfill Life Cycle

***Draw and write what happens to a can or bottle in the landfill.*** What is its life cycle there?

### 3. What Does “Reuse” Mean?

***Think about what you’ve learned and circle the correct answer.*** 

a. Break something into tiny pieces so it can be turned into something new.

b. Buy new things from the store when old ones are broken.

c. Throw something in the trash after you’re done using it.

d. Use something again instead of throwing it away or recycling it.

### 2. What Can You Reuse Today?

***Think about something you can use again instead of throwing away.*** Write or draw your answer! 

### 3. What Did You Learn?

***Finish the sentences below based on what you’ve learned.*** 

1. Recycling is like a life cycle because _____

_____.

2. If I recycle a CRV bottle or can, I can get _____.

3. I can also _____ something over and over again to help the earth.


GRADES
3-5

# Recycling Here and Beyond

## Engage students in understanding CRV recycling through both community and global perspectives!

Students engage in CRV recycling by sorting, calculating CRV redemption values, mapping local recycling centers, and researching how different countries manage recyclables. They will analyze the environmental impact of recycling and propose ways to improve local recycling systems, starting with their school and community.

**Students will be able to:**

- Explain the steps and social or environmental benefits of CRV recycling at the community level
- Use maps and graphs to describe local CRV recycling opportunities
- Compare bottle deposit recycling programs across cultures and evaluate their effectiveness

**Unit Pre-Requisites:**

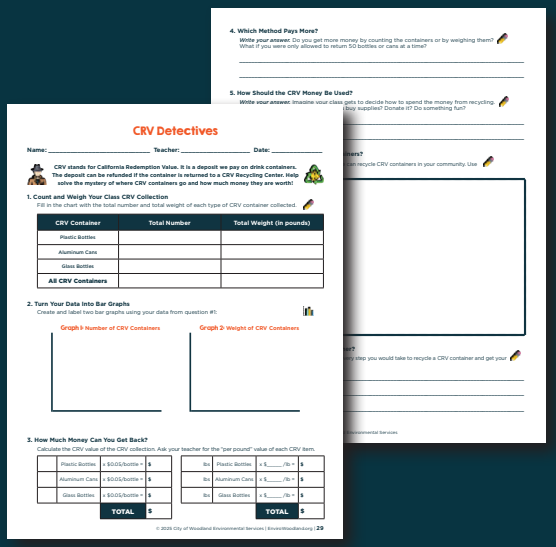
- Basic familiarity with waste sorting and the concepts of “recycling,” “composting,” and “trash”
- Ability to perform basic addition and multiplication; create simple bar graphs
- Basic understanding of maps
- Experience organizing and sharing ideas visually or verbally

# LESSON #1

# CRV Detectives

Students investigate CRV recycling through sorting, calculating, community mapping, and a student-led recycling project.

**Time Required:** 100+ minutes




## Engage (10 minutes)

- Present clean beverage containers using a camera projector or pass one out to each student or group. Prompt discussion on common and contrasting features of these items. Have students find the recycling (♺) symbol or "CRV/CA Cash Refund" logos.
- Introduce the CRV program by explaining its purpose and the process of redeeming containers at CRV recycling centers. Survey if students already participate in CRV recycling.
- Ask for ideas on why or how recycling may help the community and the environment.
- Show the 2022 Good Morning America video about Ryan Hickman (on YouTube: "Teenager recycles nearly 2 million bottles and cans in California") and discuss student takeaways.

### Materials Needed:

- Ryan Hickman CRV Recycle Video (available on YouTube)
- Handout: ***CRV Detectives***
- CRV items collected from school or home
- Bags or buckets
- Gloves
- Scale(s)
- CalRecycle Beverage Container Website: ***calrecycle.ca.gov/bevcontainer***
- City of Woodland "Sort It Out!" Grades K-6 video (available at EnviroWoodland.org)

**Optional:**

- Camera projector
- Grabber tools
- Fake currency
- CRV fundraiser supplies (see "CRV Fundraiser" resources)

## Explore (60+ minutes)

### CRV Calculations

- Coordinate with staff to collect CRV beverage containers from campus bins or have students bring containers from outside of school over a set period of time.
- Use gloves or grabbers to sort and count containers by type (plastic, aluminum, glass) into bags or buckets. Weigh each type using a scale, adjusting for the starting weight of buckets.
- Use the ***CRV Detectives*** handout to record totals and create bar graphs for each category.
- In small groups, calculate redemption values based on container count and then by weight and record responses on the handout. Compare methods (by count or by weight) to determine which yields more cash.

**Example:** 30 bottles × 5 cents each = $1.50, or 30 bottles x current CRV redemption rate (available on CalRecycle CRV website or a local CRV recycling center). Up to 50 bottles can be redeemed at a time using the counting method.

- **Optional:** Simulate a CRV recycling center exchange. Use fake currency to allow students to practice redeeming CRV containers for "cash."

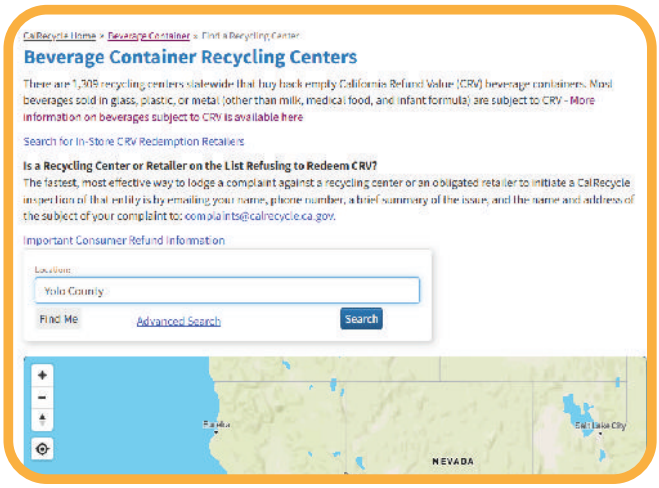
- Brainstorm possible uses for CRV earnings, exploring fun and charitable ideas. Record responses on the handout.

### CRV Community Mapping

- Display a digital map of CRV recycling centers using CalRecycle's website. Identify the closest centers to the school and nearby landmarks using satellite view.

- Use the handout to sketch roads, landmarks, or other geographic data to help map the location of local CRV recycling centers.

- Discuss accessible routes to nearby centers and brainstorm solutions if the centers are far away from the school or neighborhood.



CalRecycle's CRV Recycling Center search and map page.

## Explain (20 minutes)

- Play the City of Woodland "Sort It Out!" K-6 video (at EnviroWoodland.org).

- In small groups, outline the steps for recycling CRV containers, from identifying the CRV label to redeeming them at a CRV recycling center. Use the handout to record.

- Brainstorm ways to promote CRV recycling, such as creating posters, videos, or organizing a class or schoolwide collection drive.

## Expand (3+ days)

- Select one idea from the brainstorming session as a class and plan the steps to implement it. Identify supplies, storage needs, and the people that would need to be involved.

- If organizing a collection drive, collaborate with parent leaders or booster clubs to transport collected items to a local CRV recycling center. Define a goal and decide how to use the funds.

## Evaluate (10 minutes)

- In their handout, students properly and thoroughly detail the steps required to recycle a CRV container at a CRV recycling center in their own community.

### California Curriculum Connections:

**Science:** Analyze and interpret data to demonstrate how CRV recycling reduces waste impacts on the environment

**Language Arts:** Conduct short research on local recycling opportunities and explain recycling procedures in detail

**Math:** Calculate and graph CRV recycling data and practice money counting

**Social Studies:** Use and create maps to relate information about local recycling opportunities

# CRV Detectives

**Name:** _____ **Teacher:** _____ **Date:** _____

**CRV stands for California Redemption Value. It is a deposit we pay on drink containers. The deposit can be refunded if the container is returned to a CRV Recycling Center. Help solve the mystery of where CRV containers go and how much money they are worth!**

## 1. Count and Weigh Your Class CRV Collection

Fill in the chart with the total number and total weight of each type of CRV container collected.

| CRV Container | Total Number | Total Weight (in pounds) |
|---|---|---|
| Plastic Bottles | | |
| Aluminum Cans | | |
| Glass Bottles | | |
| **All CRV Containers** | | |

## 2. Turn Your Data Into Bar Graphs

Create and label two bar graphs using your data from question #1:

**Graph 1: Number of CRV Containers**

**Graph 2: Weight of CRV Containers**

## 3. How Much Money Can You Get Back?

Calculate the CRV value of the CRV collection. Ask your teacher for the "per pound" value of each CRV item.

| | | | |
|---|---|---|---|
| | Plastic Bottles | x $0.05/bottle = | **$** |
| | Aluminum Cans | x $0.05/bottle = | **$** |
| | Glass Bottles | x $0.05/bottle = | **$** |
| | | **TOTAL** | **$** |

| | | | |
|---|---|---|---|
| lbs | Plastic Bottles | x $_____ /lb = | **$** |
| lbs | Aluminum Cans | x $_____ /lb = | **$** |
| lbs | Glass Bottles | x $_____ /lb = | **$** |
| | | **TOTAL** | **$** |

### 4. Which Method Pays More?

***Write your answer.*** Do you get more money by counting the containers or by weighing them? What if you were only allowed to return 50 bottles or cans at a time?

### 5. How Should the CRV Money Be Used?

***Write your answer.*** Imagine your class gets to decide how to spend the money from recycling. What could you do with it? Would you buy supplies? Donate it? Do something fun?

### 6. Where Can You Recycle CRV Containers?

***Draw a simple map.*** Show where people can recycle CRV containers in your community. Use landmarks and street names.

### 7. How Do You Recycle a CRV Container?

***Write your answer.*** Number and record every step you would take to recycle a CRV container and get your deposit back.

# LESSON #2

# CRV Around the World

Students research, compare, and present on cultural recycling practices and rules from around the world.

***Note:** This lesson is best suited for 5th grade and up.*

**Time Required:** 60+ minutes


CRV Around the World
Scandinavia

Name: _____ Teacher: _____ Date: _____

**Instructions:** Read the information about recycling in Scandinavia, a region that includes the countries of Denmark, Norway, Sweden, Finland, and Iceland. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

In Scandinavia, countries like Sweden, Norway, and Finland are really good at recycling, especially bottles and cans. They use a system called *pant* (a Scandinavian word for bottle deposits) where you pay a deposit when you buy a drink. If you return the empty bottle or can to a Reverse Vending Machine (RVM), you get your money back.

Norway recycles 97 out of every 100 plastic bottles, and Finland recycles 93 out of every 100 drink containers. However, there are some challenges. Some types of plastic are hard for the region to recycle, like items made with layers of recyclable and nonrecyclable materials. These items are sent to other countries instead of being recycled locally.

These countries are also trying to make less trash in the first place, not just recycle more. Even with these challenges, Scandinavia shows how small actions, like returning bottles and cans, can make a big difference.

Sources: Science Alert, This is Finland

Many Scandinavian countries use Reverse Vending Machines (RVMs) to refund bottle deposits.

Think, Discuss, and Answer

1. What percentage of plastic bottles are recycled in Norway? All drink containers in Finland?
*Hint: Calculate the number of containers recycled divided by 100 and then multiply by 100 for each country.*

2. How do "RVMs" help get more people to recycle bottles and cans?

3. What are some waste and recycling challenges across Scandinavia?

...out recycling in Scandinavia, what would it be? Why?




Recycle Station in Japan

A recycle station at a highway rest area in Japan.

## Engage (10 minutes)

- On a whiteboard or flip chart, create a class Mind Map of what students already know about recycling in their community. Write "What I know about recycling" as the central theme. Include categories like bin colors, accepted materials, and how CRV programs work.
- Discuss differences students may have observed in recycling programs when visiting or living in other communities (example: stricter or no rules, or different bin colors and symbols).
- Display the visual of a ***Recycling Station in Japan***. Ask students to identify and discuss key differences in the design, symbols, and instructions compared to their local recycling systems (example: In Japan, people must separate each recyclable into its own category themselves, which is uncommon in the United States).
- Discuss how these types of differences relate to ideas around another country's culture around waste management, as well as science and technology.

### Materials Needed:

- Whiteboard or flip chart
- Markers
- Visual: ***Recycling Station in Japan***
- Handouts: ***CRV Around the World*** (1 region per group or student)
- Google Slides, Canva, or similar for student digital presentations

**For Non-Digital Projects:**

- Posterboards
- Markers
- Glue, tape, or other adhesives
- Clean, dry samples of waste
- Magazine cutouts of single-use and recyclable product advertisements or photographs

## Explore (30 minutes)

- Form small groups. Assign each group *one* of the ***CRV Around the World*** handouts. Each handout contains background information and questions on container deposit programs and recycling in different regions: United States, Japan, Kenya, Scandinavia, Germany, and Fiji.
- Give time to complete the handouts and provide support as needed.

## Explain (1+ days)

- Each group creates and presents a digital slideshow (or poster) highlighting how their assigned region manages their recyclable waste. Use the handout to support the planning process and encourage creativity by allowing charts, photos, drawings, and infographics.
- Discuss what ideas and solutions shared from other regions could improve local recycling efforts, especially as it pertains to beverage containers.
- **Recommended:** Invite a representative from a local recycling program or environmental organization to explain the benefits and challenges of regional CRV and recycling programs.

## Expand (15+ minutes)

- Show images or artifacts, or read a story demonstrating historical indigenous waste management practices in California and/or the Americas (example: use of biodegradable materials in daily life, early composting methods, using all parts of an animal).
- **Recommended:** Invite a representative from a local indigenous tribe or organization to speak about sustainable indigenous land and waste management practices.
- Challenge students to consider how waste has evolved over time and how that ties to modern society.

Invite professionals to present on local waste management practices or sustainability.

## Evaluate (5+ minutes)

**Rubric-Based Assessment:** Create your own rubric and evaluate presentations based on the following criteria: research quality, presentation skills, cultural and environmental understanding, and thoughtful application of knowledge.

**Journal:** Students write a short reflection paragraph explaining what they learned about recycling programs in other cultures and how we can improve our own local recycling efforts.

### California Curriculum Connections:

**Science:** Examine and interpret cause and effect relationships between recycling efforts and waste impacts on the environment

**Language Arts:** Use informational texts to gather data and present findings about recycling programs around the world

**Math:** Calculate recycle rate percentages and compare rates between countries

**Social Studies:** Examine how culture and government influences effective recycling, including the local indigenous perspective on historical and modern waste management

# Recycle Station in Japan


A recycle station at a highway rest area in Japan.

# CRV Around the World

## The United States of America

**Name:** _____ **Teacher:** _____ **Date:** _____

**Instructions:** Read the information about recycling in the United States. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

**The United States (U.S.) can recycle many things, like paper, cardboard, metal, plastic bottles, aluminum cans, and glass, but only 1 out of every 10 recyclable items actually gets recycled. Of all of the recyclable drink containers sold each year, nearly 4 out of every 10 items are recycled. This means that a lot of cans and bottles end up in the landfill instead of being turned into something new and useful, wasting resources like energy and water.**

**Some states have programs to encourage recycling. In 10 states, including California, Michigan, and Oregon, "bottle bills" charge a small fee when you buy a drink, which you get back by returning the empty container. These states recycle 30% more containers than those without such programs.**


In the United States, the State of California uses a bottle deposit program called "California Redemption Value"

**Recycling laws in the U.S. are different in each state, which can make recycling confusing. Some areas make recycling easy, while others don't have enough bins or stations. Not everyone recycles, even when it's an option. To improve, the U.S. can focus on teaching people why recycling is important and creating better systems and rules.**

Sources: United States Environmental Protection Agency, Container Recycling Institute

### Think, Discuss, and Answer

1. What percentage of all recyclables are recycled in the U.S.? What percentage of drink containers? *Hint: Calculate the number of items recycled divided by 10 and then multiply by 100.*

2. How do "bottle bills" help get more people to recycle bottles and cans?

3. What are some waste and recycling challenges in the United States?

4. If you could make a new rule about recycling in the United States, what would it be? Why?

**Use this space to plan out your presentation about recycling in the U.S.**

**You can draw, write, and design your presentation.** 

- What do you think others should know?
- What surprised you about what you learned?

# CRV Around the World

## Japan

**Name:** _____ **Teacher:** _____ **Date:** _____

**Instructions:** Read the information about recycling in Japan. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

**In Japan, people recycle items like paper, plastic bottles, cans, and glass. A special rule called the *Containers and Packaging Recycling Act* helps make recycling easy and requires companies that make containers to help pay for recycling.**

**Japan is great at recycling plastic bottles—about 9 out of every 10 bottles are recycled! To make it simple, they have machines called Reverse Vending Machines (RVMs) in stores and train stations where people can drop off empty bottles and cans. Unlike in parts of the United States, people in Japan do not receive money when they recycle at RVMs.**

Waste sorting stations are very common in Japan.

**Littering is considered very rude in Japan. If there aren't trash bins nearby, people take their trash home, which keeps streets, parks, and cities clean. Even though Japan recycles a lot, some items are burned in special factories, called incinerators, which reduces trash but can pollute the air. Japan is working on new ways to recycle more and create less air pollution. By recycling carefully and keeping spaces clean, Japan shows how people can work together to protect the planet.**

Sources: Japan Fair Trade Commission, Sumitomo Corporation, Scientific Origin

### Think, Discuss, and Answer

1. What percentage of plastic bottles are recycled in Japan?
   *Hint: Calculate the number of plastic bottles recycled divided by 10 and then multiply by 100.*

2. How do "RVMs" help get more people to recycle bottles and cans?

3. What are some waste and recycling challenges in Japan?

4. If you could make a new rule about recycling inJapan, what would it be? Why?

**Use this space to plan out your presentation about recycling in Japan.**

**You can draw, write, and design your presentation.** 

- What do you think others should know?
- What surprised you about what you learned?

# CRV Around the World

## Kenya

**Name:** _____ **Teacher:** _____ **Date:** _____

**Instructions:** Read the information about recycling in Kenya, a country in Africa. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

**In Kenya, recycling is improving. In 2019, 3 out of every 10 plastic bottles were recycled. The year before, only 1 bottle out of every 10 was recycled. There isn't much information about how many glass bottles and cans are recycled.**

**Many people in Kenya earn a living by collecting and selling recyclables, which helps make sure more bottles are recycled. To help, companies like Coca-Cola teamed up with Kenyan organizations to create plastic bottle collection and recycling programs.**

Kenya is recycling more using simple recycling stations.

**Even though recycling is getting better, there are still some problems. In some places, especially far from cities, there just aren't enough recycling centers. Recycling bins and pick up can also cost a lot of money, so many people just throw bottles away instead.**

**Kenya is working hard to recycle more and waste less. In 2017, they banned plastic bags, which helped clean up the environment. They have also started using recycled plastic to make building bricks and even roads.**

Sources: Kenya Engineer, Recycling Today

### Think, Discuss, and Answer

1. What percentage of plastic bottles were recycled in Kenya in 2019? In 2018?
*Hint: Calculate the number of plastic bottles recycled divided by 10 and then multiply by 100 for each year.*

2. How are people and companies helping Kenya recycle more?

3. What are some waste and recycling challenges in Kenya?

4. If you could make a new rule about recycling in Kenya, what would it be? Why?

**Use this space to plan out your presentation about recycling in Kenya.**

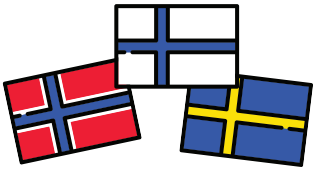
**You can draw, write, and design your presentation.** 

- What do you think others should know?
- What surprised you about what you learned?

# CRV Around the World

## Scandinavia



**Name:** _____ **Teacher:** _____ **Date:** _____

**Instructions:** Read the information about recycling in Scandinavia, a region that includes the countries of Denmark, Norway, Sweden, Finland, and Iceland. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

**In Scandinavia, countries like Sweden, Norway, and Finland are really good at recycling, especially bottles and cans. They use a system called *pant* (a Scandinavian word for bottle deposits) where you pay a deposit when you buy a drink. If you return the empty bottle or can to a Reverse Vending Machine (RVM), you get your money back.**

Many Scandinavian countries use Reverse Vending Machines (RVMs) to refund bottle deposits.

**Norway recycles 97 out of every 100 plastic bottles, and Finland recycles 93 out of every 100 drink containers. However, there are some challenges. Some types of plastic are hard for the region to recycle, like items made with layers of recyclable and nonrecyclable materials. These items are sent to other countries instead of being recycled locally.**

**These countries are also trying to make less trash in the first place, not just recycle more. Even with these challenges, Scandinavia shows how small actions, like returning bottles and cans, can make a big difference.**

Sources: Science Alert, This is Finland

### Think, Discuss, and Answer

1. What percentage of plastic bottles are recycled in Norway? All drink containers in Finland?
   *Hint: Calculate the number of containers recycled divided by 100 and then multiply by 100 for each country.*

2. How do "RVMs" help get more people to recycle bottles and cans?

3. What are some waste and recycling challenges across Scandinavia?

4. If you could make a new rule about recycling in Scandinavia, what would it be? Why?

**Use this space to plan out your presentation about recycling in Scandinavia.**

**You can draw, write, and design your presentation.** 

- What do you think others should know?
- What surprised you about what you learned?

# CRV Around the World

## Germany

**Name:** _____ **Teacher:** _____ **Date:** _____

**Instructions:** Read the information about recycling in Germany, a country in Europe. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

**In Germany, people recycle things like paper, plastic bottles, cans, and glass. They have a bottle deposit system called *pfand* where people pay extra money when they buy a drink at the store. If they return the empty bottle or can to a machine (called a Reverse Vending Machines or RVM) in a store, they get their money back. This helps Germany recycle about 98 out of every 100 drink containers.**

**Germany also makes companies pay to recycle the packaging they make. This encourages companies to design packaging that's easier and cheaper to recycle.**

**Still, there are problems. Some people put trash in recycling bins by mistake, which makes it harder to recycle. This is called "contamination." Some areas in Germany charge fines to people that contaminate recycling.**

Sources: The Times

Some parts of Germany use Reverse Vending Machines (RVMs) to refund bottle deposits.
Image: infomigrants.net

### Think, Discuss, and Answer

1. What percentage of all drink containers are recycled in Germany?
*Hint: Calculate the number of drink containers recycled divided by 100 and then multiply by 100.*

2. How do "RVMs" help get more people to recycle bottles and cans?

3. What are some waste and recycling challenges in Germany?

4. If you could make a new rule about recycling in Germany, what would it be? Why?

**Use this space to plan out your presentation about recycling in Germany.**

**You can draw, write, and design your presentation.** 

- What do you think others should know?
- What surprised you about what you learned?

# CRV Around the World

## Fiji

**Name:** _____ **Teacher:** _____ **Date:** _____

**Instructions:** Read the information about recycling in Fiji, a country made up of over 330 islands in the Southern Pacific Ocean. Review each question that follows and discuss each answer with your team. Then work with your team to prepare a presentation about what you learned.

**In Fiji, people are working hard to recycle things like plastic bottles, cans, and glass to keep their islands clean. One big program is called *Mission Pacific*, started in 1999 by Coca-Cola. This program collects over 200 tons of plastic bottles and cans every year! People bring their empty drink containers to special centers, where they are collected and sent overseas to be recycled.**

**Fiji also has the *Lase Vou* program, which helps hotels and resorts collect empty glass bottles for recycling. Right now, about 4 out of every 10 drink containers in Fiji are recycled, but the country is trying to raise that number.**


Hotels, companies, locals, and international organizations work together to improve recycling in Fiji.
Image: usaid.gov

**Even with these programs, Fiji faces challenges. Some people burn plastic waste because there aren't enough recycling centers, which can pollute the air and harm people's health. To help fix this, Fiji is planning a bottle-deposit program so more people will return their bottles and cans to be recycled.**

Sources: Mission Pacific Fiji, Fiji Intercontinental

### Think, Discuss, and Answer

1. What percentage of drink containers are recycled in Fiji?
*Hint: Calculate the number of drink containers recycled divided by 10 and then multiply by 100.*

2. Fiji is a popular vacation place. What role do hotels play in making sure bottles are recycled?

3. What are some waste and recycling challenges in Fiji?

4. If you could make a new rule about recycling in Fiji, what would it be? Why?

**Use this space to plan out your presentation about recycling in Fiji.**

**You can draw, write, and design your presentation.** 

- What do you think others should know?
- What surprised you about what you learned?

GRADES
6-8

# From Waste to Wonder

**Excite students with hands-on activities that uncover the challenges in recycling and waste, and the possibilities of creative solutions!**

Students model landfill capacity, explore the benefits of CRV recycling and composting, and turn everyday waste into innovative upcycled projects. By blending science, math, creativity, and design, this unit inspires students to rethink waste and take action to protect the environment.

**Students will be able to:**

- Use math and modeling to articulate the impact of recycling and composting on waste management
- Construct arguments for recycling or upcycling as solutions to environmental problems
- Use design thinking to reimagine waste as valuable resources for everyday use

**Unit Pre-Requisites:**

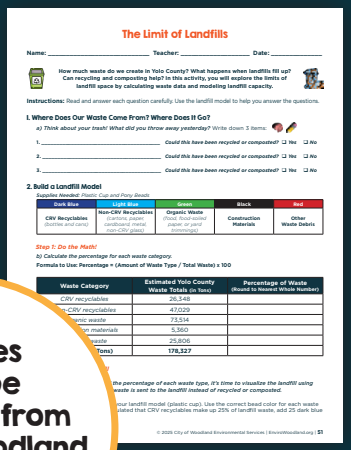
- Basic ability to calculate percentages and proportional relationships
- Familiarity with recyclable, compostable, and non-recyclable waste items
- Basic experience with tools like Canva, Google Slides, or craft supplies

LESSON #1

# The Limit of Landfills

Students calculate waste data, model landfill capacity, and discover the impact of recycling and composting through engaging projects.

**Time Required:** 60+ minutes


The Limit of Landfills

Name: _____ Teacher: _____ Date: _____

How much waste do we create in Yolo County? What happens when landfills fill up? Can recycling and composting help? In this activity, you will explore the limits of landfill space by calculating waste data and modeling landfill capacity.

Instructions: Read and answer each question carefully. Use the landfill model to help you answer the questions.

1. Where Does Our Waste Come From? Where Does It Go?

a) Think about your trash! What did you throw away yesterday? Write down 3 items

1. _____ Could this have been recycled or composted? ☐ Yes ☐ No
2. _____ Could this have been recycled or composted? ☐ Yes ☐ No
3. _____ Could this have been recycled or composted? ☐ Yes ☐ No

2. Build a Landfill Model

Supplies Needed: Plastic Cup and Pony Beads

| Dark Blue | Light Blue | Green | Black | Red |
|---|---|---|---|---|
| CRV Recyclables (bottles and cans) | Non-CRV Recyclables (cartons, paper, cardboard, metal, non-CRV glass) | Organic Waste (food, food soiled paper, or yard trimmings) | Construction Materials | Other Waste Debris |

Step 1: Do the Math!

b) Calculate the percentage for each waste category.

Formula to Use: Percentage = (Amount of Waste Type / Total Waste) x 100

| Waste Category | Estimated Yolo County Waste Totals (in Tons) | Percentage of Waste (Round to Nearest Whole Number) |
|---|---|---|
| CRV recyclables | 26,548 | |
| Non-CRV recyclables | 47,029 | |
| Organic waste | 73,514 | |
| Other materials | 5,360 | |
| Other waste | 25,806 | |
| Total (Tons) | 178,327 | |

...the percentage of each waste type, it's time to visualize the landfill using ...waste is sent to the landfill instead of recycled or composted.

...your landfill model (plastic cup). Use the correct bead color for each waste ...stated that CRV recyclables make up 25% of landfill waste, add 25 dark blue

 51

**Supplies may be available from City of Woodland Environmental Services!**

## Engage (10 minutes)

- Distribute the ***Limit of Landfills*** handout. Have students reflect on what items they threw away in the trash over the past day and record them. Invite group responses and record on a board or flip chart.
- Reflect on terms like "recycling" and "composting," and explore their meanings.
- Play the City of Woodland "Sort It Out!" Grades 7-8 video (at EnviroWoodland.org).
- Refer to the student-generated list. Discuss listed items that could be recycled or composted instead of thrown away. Have students circle items on their handout.
- Discuss why certain items end up in the trash and how this impacts the local landfill and environment.

## Explore (30 minutes)

### Preparation

- Distribute a clear, 8 ounce plastic cup and the pony beads to every student or small group.
- Introduce the materials:
  - The cup represents the Yolo County Central Landfill and its limited capacity.
  - Bead colors correspond to types of waste.
- Explain the process: Use the handout to calculate the percentage of waste in each category and add beads to the landfill model (one bead = 1%, rounded up).

## Materials Needed:

- City of Woodland "Sort It Out!" Grades 7-8 video (available at EnviroWoodland.org)
- Handout: ***Limit of Landfills***
- Clear 8 ounce plastic cups (1 per student or group)
- Pony beads: dark blue, light blue, green, black, red (~50 of each color per student or group)

**Optional:**

- Calculators
- Access to Canva, Google Slides, or paper, markers, and a camera for digital artwork project

Example of the lesson landfill model.

| Dark Blue | Light Blue | Green | Black | Red |
|---|---|---|---|---|
| **CRV Recyclables** *(bottles and cans)* | **Non-CRV Recyclables** *(cartons, paper, cardboard, metal, non-CRV glass)* | **Organic Waste** *(food, food soiled paper, or yard trimmings)* | **Construction Materials** | **Other Waste Debris** |

### Guided Example

- Point out that one ton is roughly the same weight as a small car (example: Honda Fit or Mini Cooper), an adult bison or great white shark, or a pallet of bricks.
- Work through an example:

> ***"If 178,327 tons of waste is disposed of in Yolo County each year, and 26,348 tons are CRV recyclables, what percentage of the waste is CRV? Divide 26,348 by 178,327 and multiply by 100 to get the percentage and round up (answer = 15%). We add 15 dark blue beads to the cup, 1 per percentage point."***

### Landfill Model Activity

- Students use the handout to complete calculations for all five waste categories and add the corresponding beads to the cup (landfill model).
- Reflect and record observations on the handout: "What do you notice about the landfill model? How might diverting recyclables or organic materials affect its capacity?"
- Students remove the dark blue beads (CRV recyclables) and use the handout to record observations about the impact of diverting CRV products from the landfill on the total waste volume. Repeat for the recyclable and organic waste categories, noting changes in landfill capacity each time.

## Explain (10 minutes)

- Students use the handout to discuss and explain why diverting recyclables and compostables from the landfill is helpful for the environment.
- Discuss the importance of diverting recyclables and compostables from landfills, focusing on benefits such as cost savings, reduced odors, availability of cheaper recycled materials, and climate change mitigation.
- Brainstorm and/or research the advantages of reducing landfill waste. Review key topics like landfill costs, environmental benefits, and how small actions (example: recycling CRV bottles or composting) contribute to broader solutions for environmental problems like climate change.

## Expand (3+ days)

- Assign a digital meme or infographic project where students promote CRV recycling, composting, or waste reduction.
- Use free tools like Canva, Google Slides, or paper-and-marker designs that can be photographed for display. Projects must include a catchy message, a related image, a call to action, and citations for sources, if applicable.
- Display the completed work in the classroom, on a class platform, or through school-wide communication channels as part of an educational campaign.

## Evaluate (10+ minutes)

- Facilitate a presentation where students review and reflect on each group's digital art projects. Students discuss which projects are most effective at relating the issues and inspiring others to properly sort their waste items.
- Students complete the handout describing an action they plan to take and why it is important to them.

### California Curriculum Connections:

**Science:** Use a model and construct arguments for recycling and composting as a solution to several environmental problems

**Language Arts:** Present findings through digital projects to promote recycling and waste reduction

**Math:** Calculate percentages of waste categories, measure, and determine proportional relationships

**Social Studies:** Discuss how rules, laws, and civic responsibility contribute to environmental conservation and community well-being

# The Limit of Landfills

**Name:** _____ **Teacher:** _____ **Date:** _____

**How much waste do we create in Yolo County? What happens when landfills fill up? Can recycling and composting help? In this activity, you will explore the limits of landfill space by calculating waste data and modeling landfill capacity.**

**Instructions:** Read and answer each question carefully. Use the landfill model to help you answer the questions.

## I. Where Does Our Waste Come From? Where Does It Go?

*a) Think about your trash! What did you throw away yesterday?* Write down 3 items:


1. _____ ***Could this have been recycled or composted?*** ❑ ***Yes*** ❑ ***No***
2. _____ ***Could this have been recycled or composted?*** ❑ ***Yes*** ❑ ***No***
3. _____ ***Could this have been recycled or composted?*** ❑ ***Yes*** ❑ ***No***

## 2. Build a Landfill Model

***Supplies Needed:*** *Plastic Cup and Pony Beads*

| Dark Blue | Light Blue | Green | Black | Red |
|---|---|---|---|---|
| **CRV Recyclables** *(bottles and cans)* | **Non-CRV Recyclables** *(cartons, paper, cardboard, metal, non-CRV glass)* | **Organic Waste** *(food, food-soiled paper, or yard trimmings)* | **Construction Materials** | **Other Waste Debris** |

### *Step 1: Do the Math!*

***b) Calculate the percentage for each waste category.***

**Formula to Use: Percentage = (Amount of Waste Type / Total Waste) x 100**

| Waste Category | Estimated Yolo County Waste Totals (in Tons) | Percentage of Waste (Round to Nearest Whole Number) |
|---|---|---|
| *CRV recyclables* | 26,348 | |
| *Non-CRV recyclables* | 47,029 | |
| *Organic waste* | 73,514 | |
| *Construction materials* | 5,360 | |
| *All other waste* | 25,806 | |
| **Total Waste (Tons)** | **178,327** | |

### *Step 2: Fill Your Landfill*

***Now that you've calculated the percentage of each waste type, it's time to visualize the landfill using beads. Imagine every bit of waste is sent to the landfill instead of recycled or composted.***

Each 1% of waste = 1 bead in your landfill model (plastic cup). Use the correct bead color for each waste type. For example, if you calculated that CRV recyclables make up 25% of landfill waste, add 25 dark blue beads to your cup.

*c) What do you notice about how much space different types of waste take up?*

### *Step 3: Recycle and Compost More*

***The landfill is filling with materials that can actually be recycled or composted and used again. It's time to visualize what happens when we keep recyclables and organics out of the landfill.***

Remove CRV recyclables (dark blue beads) and see what happens to the landfill. Then remove non-CRV recyclables (light blue beads), followed by compostable materials (green beads).

*d) What happens when we keep recyclables and compost out of the landfill?*

## 3. Think, Discuss, and Answer!

*e) What surprised you the most about the amount of waste in the landfill?*

*f) What would improve if we kept all recyclable and organic waste out of the landfill?*

*g) How can small actions like recycling at a CRV recycling center help with big environmental problems?*

*h) If you were in charge of your community's waste management rules, what rule would you create to reduce landfill waste? Why?*

*i) What will you do differently as a result of what you've learned?*

# LESSON #2

# Upcycling Workshop

Students explore the concepts of CRV recycling and upcycling while creating functional, decorative, or innovative projects from waste materials.

**Time Required:** 100+ minutes


## Engage (10 minutes)

- Discuss common waste disposal methods (recycling, composting, landfill).
- Prompt reflection on the recycling process and what happens to an item when it is recycled.
- Use examples of CRV containers to guide discussion on how recyclables are broken down into raw materials and repurposed.
- Introduce upcycling as transforming waste items into something useful without breaking them down. Share upcycled project examples from the ***Upcycled Projects*** visuals or online. Students may also do their own research.
- Inspire discussion on favorite upcycled projects and how they may have been created.

### Materials Needed:

- Visuals: ***Upcycled Projects***
- Empty and clean drink containers
- Scrap paper and cardboard
- Magazines and newspaper
- Fabric scraps
- Scissors
- Decoupage supplies
- Adhesives (tape, hot glue gun, glue sticks)
- Various art media (examples: paint, markers, colored pencils)
- Various craft media (examples: beads, yarn, twine, stencils)
- Rules or measuring tape
- Sandpaper

## Explore (2+ days)

### Upcycle Workshop

- Provide a variety of clean waste materials, recyclables, and craft supplies.
- Encourage open experimentation and brainstorming with the provided supplies. Invite discussion on how the materials and ideas can be combined to replace items that are typically purchased new, or ideas that could solve an existing problem.
- Alternatively, offer a few categories of project ideas (example: household items, toys, tools, art, or storage solutions) and ask for sketches or written plans detailing materials, tools, and time needed prior to experimentation.
- Provide time for students to turn ideas into upcycled products, supporting their creativity and experimentation.

## Explain (50+ minutes)

### Presentation

- Students share completed projects with the class or in small groups. Presentations should cover the project's purpose, materials used, challenges faced and solutions found, and results.

### Upcycling vs. Recycling Debate

- Discuss the trade-offs between upcycling and recycling. Use guiding questions:
  - "Does upcycling divert waste from landfills more effectively than recycling?"

    **Answer:** *Upcycling keeps items out of the landfill for some time, but may have to be thrown away eventually. Items with glue, paint, or mixed materials cannot be recycled.*

  - "How do you think the amount of energy and water required for upcycling compares to recycling?"

    **Answer:** *At least 50% more energy and water is required to recycle something than is needed to upcycle it.*

  - "Can you still redeem upcycled bottles and cans for the CRV deposit?"

    **Answer:** *Only if they are stripped down to the original container and the CRV or CA Cash Refund logos are still visible.*

- Reflect on how the quality, durability, and purpose of upcycled items might justify the choice to either upcycle or recycle an item.

## Expand (30+ minutes)

### Cost vs. Benefit Analysis

- Students research the cost, time, and/or materials needed to purchase a version of their upcycled (or similar item) brand new.
- Discuss whether the upcycled item offers unique value, such as cheaper cost, customizability, lower environmental impact, or more personal significance than the new, purchased version.

### Upcycle Fair

- Host a class exhibit to showcase upcycled projects, either through a "fair" or display case.
- **Optional:** Add student-designed informational posters about upcycling and its benefits, QR codes to short student-generated videos about the project, or hands-on opportunities for participants to create their own projects.

## Evaluate (10+ minutes)

- **Rubric-Based Assessment:** Create a rubric to evaluate student work based on the following criteria: creativity and functionality of the upcycled project, effort and problem-solving demonstrated, and understanding and articulation of environmental impact of their project.
- **Journaling or Class Discussion:** Students write a short reflection paragraph explaining what they learned about upcycling and its impact on the environment, and how to apply upcycling concepts to reduce waste in daily life.

### California Curriculum Connections:

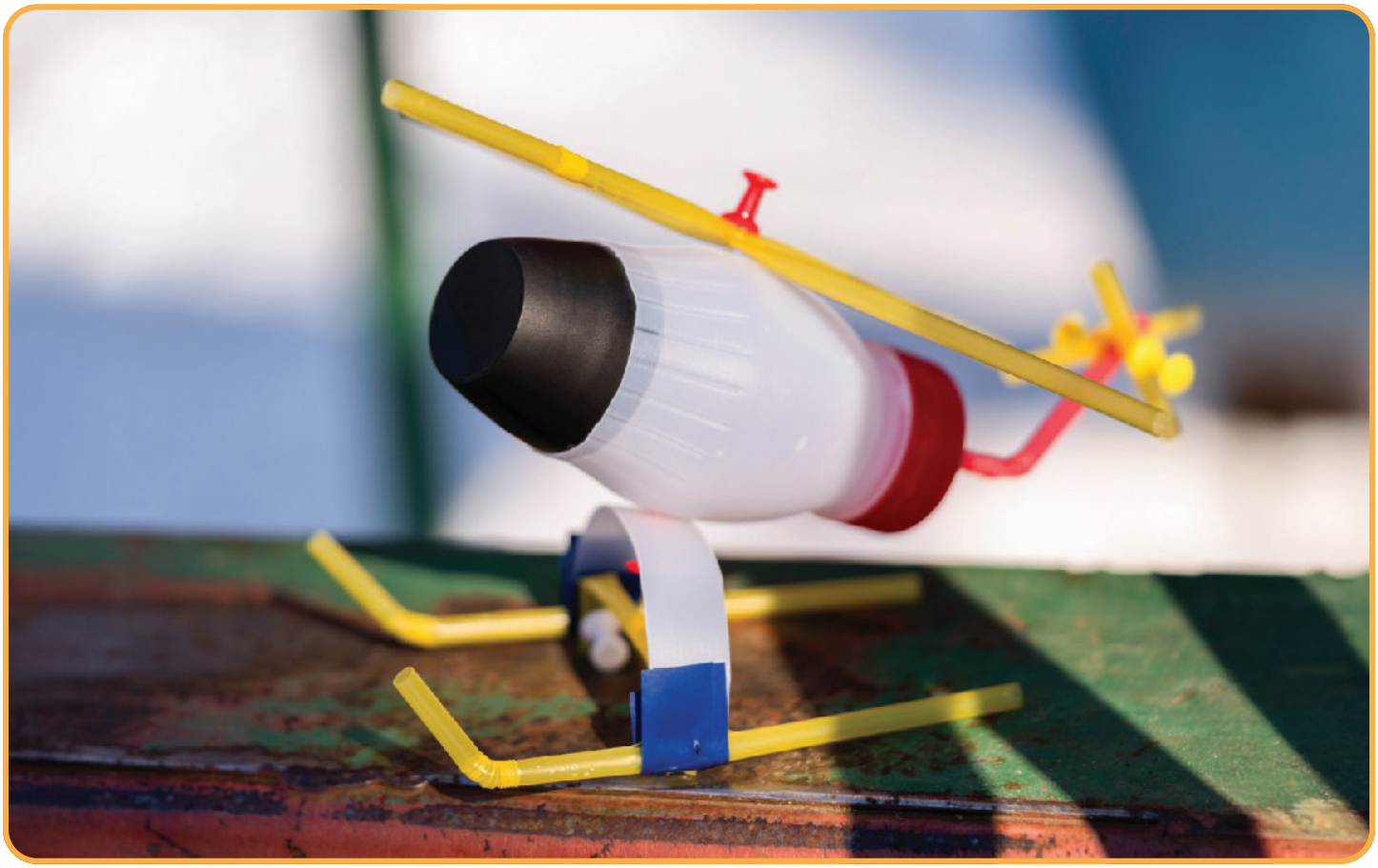
**Science:** Identify problems and solve waste issues using creative designs and experimentation

**Language Arts:** Research, debate, and present projects regarding recycling and upcycling

**Math:** Compare costs of upcycling versus buying new and calculate cost savings

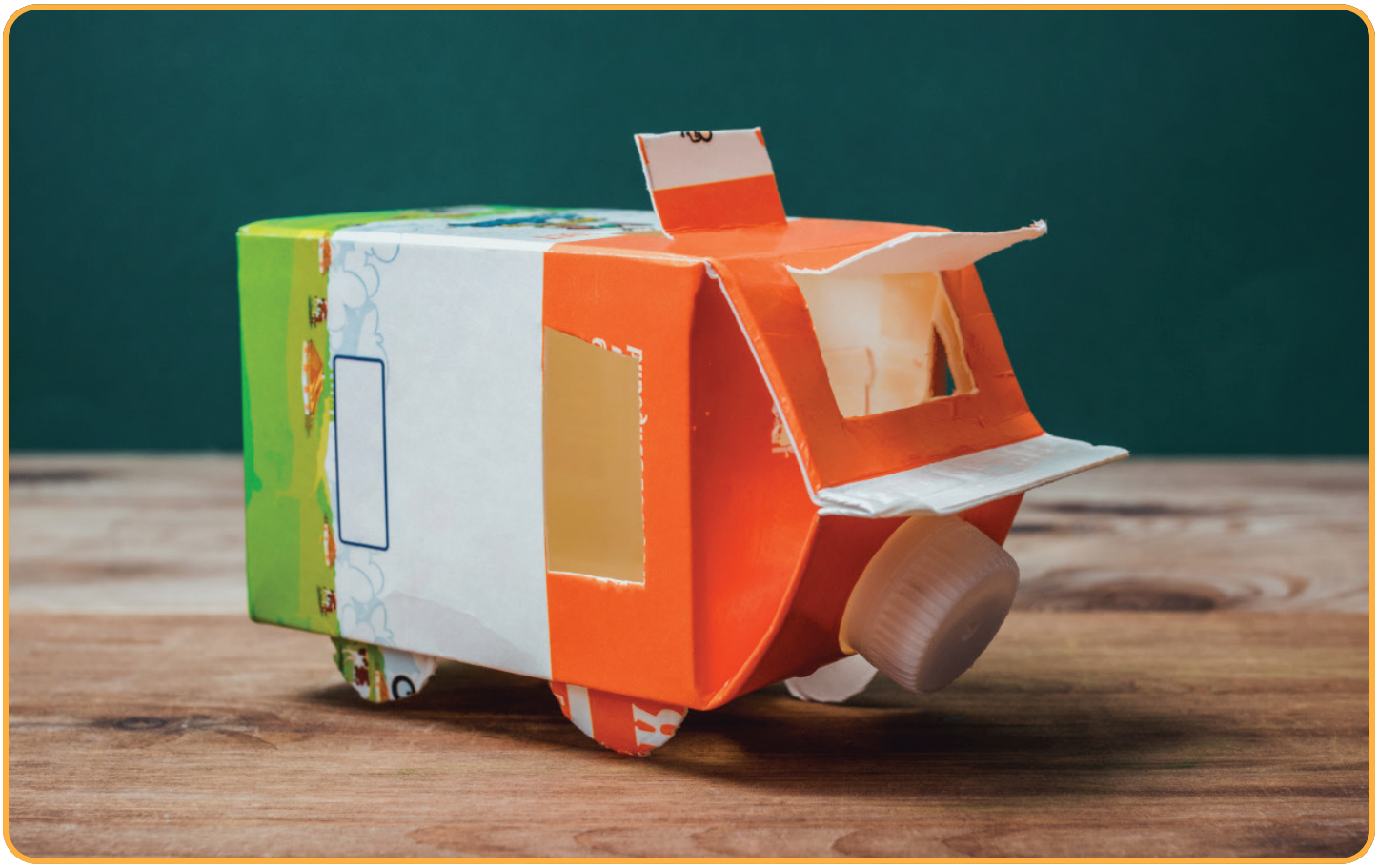
**Social Studies:** Analyze how innovation can reduce waste and improve society

**A plastic drink bottle upcycled into a planter.**

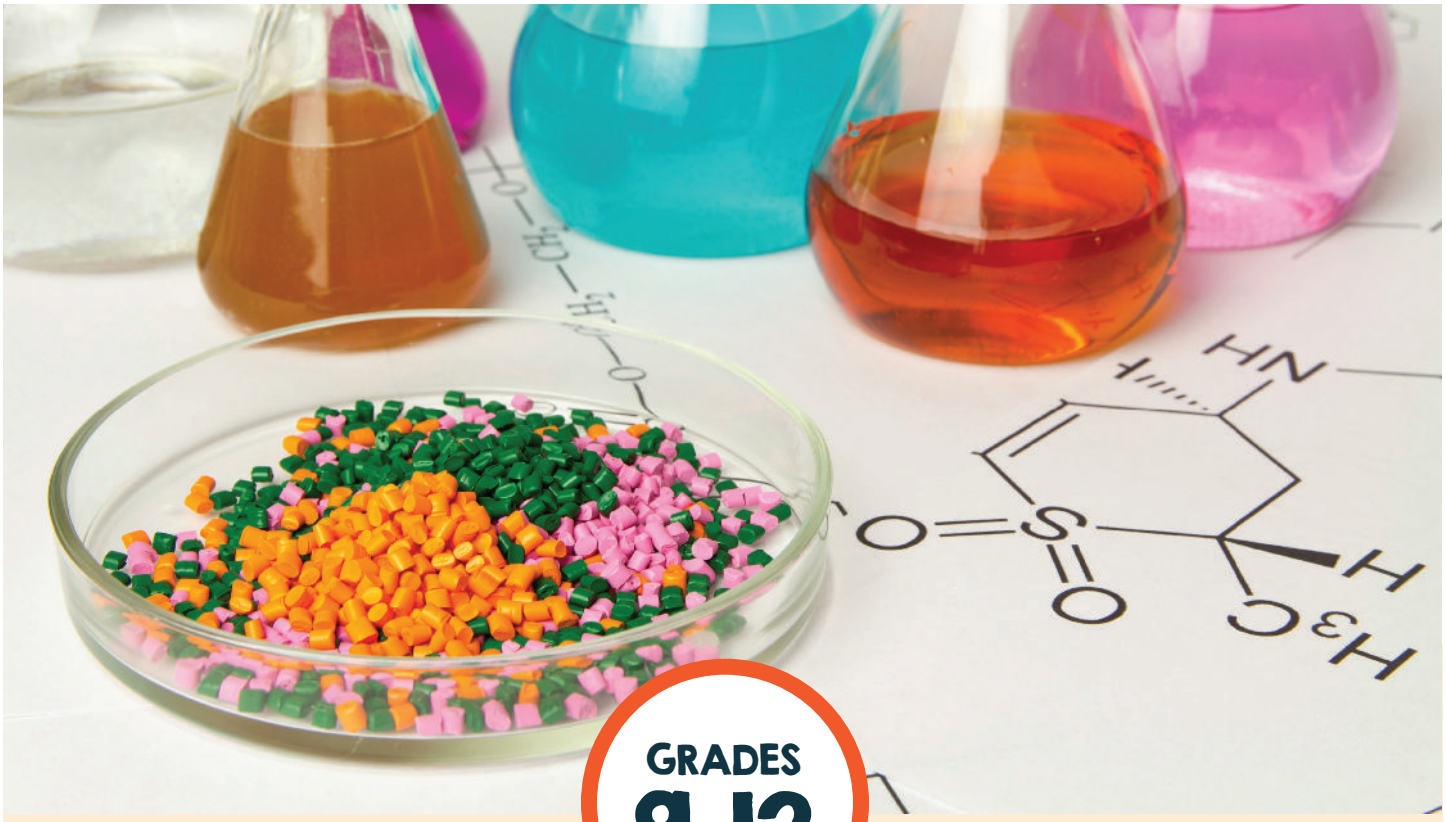


**Straws, bottle caps, and other plastic upcycled into a helicopter model.**

**Tin cans upcycled into decorative wind chimes.**



**Milk carton upcycled into a toy vehicle.**



GRADES
9-12

# The Science of Sorting

## Engage students in the science behind recycling through hands-on investigations of CRV materials.

Students explore the physical and chemical properties of plastics, metals, and glass and apply their findings to design a "recycling facility." This environmental STEAM lesson connects real-world challenges with critical thinking on sustainable waste solutions.

**Students will be able to:**

- Describe the physical and chemical properties of common CRV recyclables
- Explain how an item's density, magnetism, chemical composition, and ability to refract light impact recycling processes
- Design and present a model recycling facility using science-based solutions for sorting CRV materials

**Unit Pre-Requisites:**

- Basic understanding of density, magnetism, and light refraction
- Compliance with and respect for basic lab safety and supply handling protocols
- Ability to perform basic calculations and interpret relationships between variables

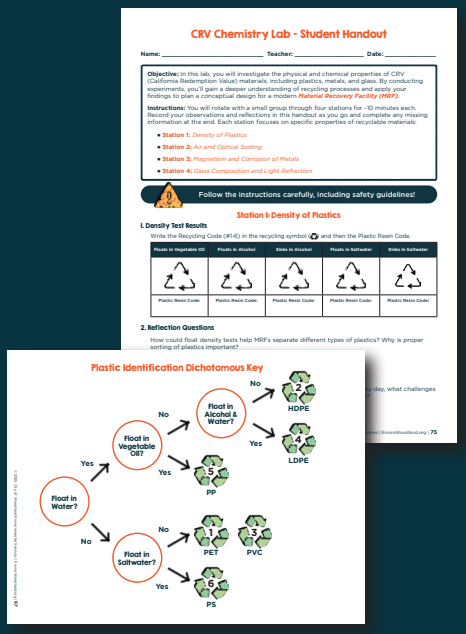
# LESSON #1

# CRV Chemistry:

## Exploring Properties of Recyclables

Students investigate the physical and chemical properties of CRV materials (plastic, metal, and glass) and apply results to design a model recycle sorting facility. Facilitate over several days.

**Time Required:** 110+ minutes




## Engage (10 minutes)

- Present CRV recyclable items such as a plastic water bottle, aluminum can, and glass bottle. Discuss the challenges and ease of recycling these materials in daily life.
- Play the City of Woodland "Sort It Out!" Grades 9-12 video (at EnviroWoodland.org). Highlight the CRV recycling program.
- Introduce the lab as an investigation of the physical and chemical properties of CRV materials and their role in recycling processes.

## Explore (45 minutes)

### Preparation

- Follow the ***Lab Setup and Safety Guide for Teachers*** handout to prepare materials and ensure safety protocols are in place and followed.
- Distribute the ***CRV Chemistry Lab*** student handout. Review setup, procedures, and key terms such as density, magnetism, eddy currents, corrosion, and optical sorting.

### Materials Needed:

***Refer to "Lab Setup and Safety Guide for Teachers" handout for all lab supplies***

- City of Woodland "Sort It Out!" Grades 9-12 video (available at EnviroWoodland.org)
- Waste Management "Sacramento Recycling and Transfer Station" video (available on YouTube)
- SciShow "How Recycling Works" video (available on YouTube)
- Aluminum Can
- Plastic Bottle
- Clear, Green, Brown Glass Bottles
- Handout: ***CRV Chemistry Lab***

### Lab Overview

- **Test 1:** *Density of Plastics.* Use density tests and a dichotomous key to distinguish PET plastic (#1) from other plastic types (#2-#6).
- **Test 2:** *Air and Optical Sorting.* Simulate how optical sensors and air jets sort materials based on their physical properties.
- **Test 3:** *Magnetism and Corrosion of Metals.* Test aluminum and steel for magnetism and corrosion resistance to demonstrate why aluminum recycling is easy.
- **Test 4:** *Glass Composition and Light Refraction.* Explore how colored glass transmits and refracts light differently than clear glass and how mixed glass impacts recycling processes.

## Explain (45 minutes)

- Provide 10 minutes for students to complete any unfinished experiments and responses on their handout.
- Play the SciShow "How Recycling Works" video (on YouTube).
- Facilitate discussion on the different experiments:

**Test 1:** *Density of Plastics*

- Discuss student observations regarding the relationship between plastic density and recycling codes.
- Discuss if float density tests are an efficient way to sort hundreds of thousands of tons of plastic recycled locally each year. Brainstorm ideas for making plastic waste sorting more efficient based on the results of the other experiments.
- Review that most facilities have transitioned to air and optical sorting systems for their efficiency and smaller environmental impact.

**Test 2:** *Optical and Air Sorting*

- Discuss observations from the optical and air sorting simulations. Invite ideas on efficiency and how the method can be applied in a recycle sorting scenario.
- Review near-infrared (NIR) technology used to detect resin types and glass color and how this technology signals air jets to blow objects onto different conveyor belts.
- Discuss what challenges recycling facilities might face with mixed materials, or lightweight or irregularly shaped plastics (example: plastic shopping bags or sandwich bags).
- Have a student try to blow a plastic bag onto a target to highlight the inefficiencies that prevent some recyclables from being recycled.

**Test 3:** *Magnetism and Corrosion of Metals*

- Compare and contrast the importance of steel's magnetic properties in the context of sorting aluminum.
- **Optional:** Perform an eddy current experiment (ideas available online) to demonstrate how eddy currents are used to sort aluminum from mixed recyclables.
- Discuss how steel's susceptibility to corrosion affects its recyclability and why aluminum's resistance to corrosion makes it a more efficient material for recycling.

**Test 4:** *Glass Composition and Light Refraction*

- Discuss refraction and how different glass colors refract light. Relate variations in refraction to chemical composition.
- Present clear, green, and brown glass bottles. Connect glass colors to the manufacturing process, explaining how mixed-color cullets (crushed glass) can contaminate recycled glass products and reduce quality.
- Discuss how optical sorting systems identify glass profiles and the challenges posed by contaminated glass products.

## Expand (2+ days)

- Introduce Yolo County's Material Recovery Facility (MRF): the Sacramento Recycling and Transfer Station (SRTS). Play Waste Management's "Sacramento Recycling & Transfer Facility" video (on YouTube).

### Design Challenge

- Organize students into small teams tasked with designing a MRF capable of sorting mixed CRV containers into three categories: plastic bottles, aluminum cans, and glass bottles.
- Require detailed outlines or sketches and captions explaining how specific tools or systems (example: density tank, magnets/eddy current separators, air or optical sorters) would be used.
- Groups present and discuss designs, comparing approaches and challenges.

### Optional Extension

- Teams build physical models of their designs using repurposed/upcycled materials or STEAM kits.
- Display or present models at a school event to showcase student work. Provide awards or complete a recognition ceremony.

Model MRF designed to sort recycling (beads) by size.

## Evaluate (10+ minutes)

- **Exit Ticket:** Students complete an exit ticket explaining the most surprising thing they learned about recyclables and how they will improve their own recycling habits.
- **Rubric-Based Assessment:** Create a rubric and evaluate team recycling center design projects based on: creativity, practicality of their design, and application of recycling principles.

### California Curriculum Connections:

**Science:** Conduct investigations on the physical and chemical properties of recyclable materials and how those properties influence the recycling process

**Language Arts:** Integrate technical information with visual representations to justify and explain recycling processes

**Math:** Use functions to model relationships between material properties (example: density, magnetism, refractive index) and sorting efficiency

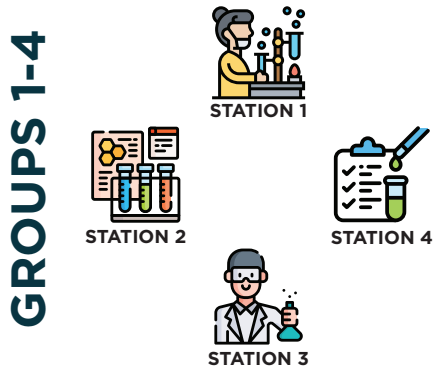
**Social Studies:** Examine the relationship between science and public policy for addressing social and environmental problems

# CRV Chemistry Lab

## Setup and Safety Guide for Teachers

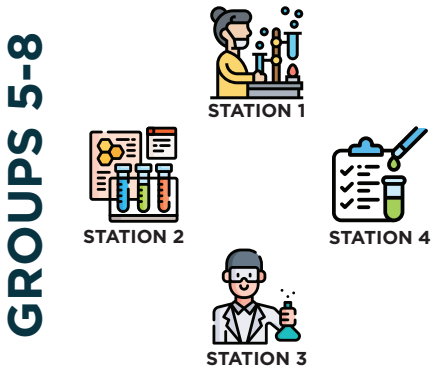
**Supplies may be available from City of Woodland Environmental Services!**

**Station Supplies and Setup:** Set up two stations per test (double the supplies listed below) and divide students into eight groups. Groups 1-4 will rotate through the first set of tests, while groups 5-8 rotate through the second set. Provide 10 minutes per rotation.




**Per Student Materials:**

- Handout: ***CRV Chemistry Lab***
- Goggles, Gloves, Aprons, etc.
- Access to Soap and Water




### Station I: Density of Plastics

- ❑ Station 1 instructions (printed and laminated)
- ❑ **(5)** plastic samples per plastic #1 to #6, cut into approximately 1 inch pieces (30 total), stored in a ~4 oz container labeled "Starting Sample"
- ❑ **(4)** glass beakers, labeled and prepared with:
  - ❑ **(1)** 1000 mL: deionized (DI) water
  - ❑ **(1)** 400 mL: saltwater solution (10 grams table salt dissolved per 100 mL DI water)
  - ❑ **(1)** 400 mL: vegetable oil
  - ❑ **(1)** 400 mL: alcohol/water solution (125 mL 91% isopropyl alcohol, 275 mL deionized water)
- ❑ **(4)** handled sieves (<2") or spoons, each labeled "DI", "saltwater", "oil", or "alcohol"
- ❑ **(6)** 4 oz containers for extra plastic samples, each labeled "#1 extra" up to "#6 extra"
- ❑ **(1)** 4 oz container labeled "Dirty Samples" unmarked
- ❑ paper towels

- Only use the pre-prepared solutions as outlined in the setup (e.g., deionized water, saltwater, vegetable oil, and alcohol solution).
- Handle glassware with care to avoid spills, damage, or injury.
- Prevent spills by placing beakers on sturdy, flat surfaces and using trays to catch any potential overflow.
- Instruct students to handle spoons carefully to minimize splashing.
- Avoid direct contact with isopropyl alcohol; use tweezers or tongs to handle materials. If contact occurs, thoroughly rinse the affected area with water.
- Do not dispose of vegetable oil down the drain. Instead, return the oil to its container and discard it in the trash if contaminated.

## Station 2: Air and Optical Sorting

- ❑ Station 2 instructions (printed and laminated)
- ❑ Bin of clean, mixed trash and CRV containers
- ❑ **(4-5)** sets of rubber gloves
- ❑ **(4-5)** aprons
- ❑ **(1)** 6 foot table or bench
- ❑ **(1)** 8 ft x 2 ft strip of dark colored butcher paper
- ❑ **(1-2)** trash bins
- ❑ **(1)** LED flashlight (**optional:** add laser pointer)
- ❑ **(1)** hair dryer on cool setting (concentrator nozzle recommended) and power outlet
- ❑ **(2)** pieces of colored paper "targets" placed on an elevated surface located ~2, 4, and 6 feet away

- Do not use glass products or fragile items.
- Position the station in a location away from high-traffic areas due to potential flying/falling objects and to ensure hair dryer cords will not become tripping hazards.
- Set up hair dryers with the cool setting enabled and instruct students to aim them only at designated objects.
- Ensure flashlights or lasers are used responsibly, with their beams kept away from people's eyes.
- Emphasize caution when handling lightweight materials, as they may be propelled at unexpected speeds or directions.

## Station 3: Magnetism and Corrosion of Metals

- ❑ Station 3 instructions (printed and laminated)
- ❑ **(1)** aluminum can tab, plus extra
- ❑ **(1)** steel sample (example: washers, bolts, nuts)
- ❑ **(1)** steel sample pre-treated in vinegar for 2 days (removes coatings and initiates rusting)
- ❑ **(1)** beaker filled with 200 mL 10% vinegar
- ❑ **(2)** long-handled tweezers or tongs
- ❑ **(1)** ceramic craft magnet, plus extra
- ❑ **(1)** set of assorted flat and lock steel washers (150 g minimum), plus extra
- ❑ **(1)** digital scale (grams)
- ❑ **(1)** clean and empty aluminum can
- ❑ paper towels

- Use tweezers to avoid contact with strong vinegar. In case of accidental contact, rinse the skin thoroughly with water.
- Perform tests in a well ventilated area. Coatings on steel will interact with vinegar to form very small amounts of hydrogen gas.
- Clean any spills immediately with paper towels to maintain a safe workspace.
- Collect and dispose of corroded materials in a designated waste container following local waste management protocols.
- People with pacemakers should take caution when using or around magnets.

## Station 4: Glass Composition and Light Refraction

- ❑ Station 4 instructions (printed and laminated)
- ❑ **(1)** beaker containing 300 mL deionized water
- ❑ **(1)** beaker containing 300 mL vegetable oil
- ❑ **(1)** flashlight
- ❑ **(1)** wall or flat vertical surface
- ❑ **(2)** sheets white paper
- ❑ **(1)** set of color paddles (various colors)
- ❑ **(1)** 8 oz container
- ❑ **(4+)** 4 oz plastic cups
- ❑ **(1)** bag of mixed color, transparent beads
- ❑ **(1)** timer or stopwatch

- Handle glassware with care to avoid spills, damage, or injury.
- Adhere to strict safety guidelines when using the LED flashlight. Never aim flashlights at eyes or reflective surfaces to prevent harm.

# CRV CHEMISTRY LAB

## STATION #1

### Density of Plastics

**Time:** 10 minutes

**Objective:** Use density tests and the ***Plastic Identification Dichotomous Key*** to distinguish PET plastic (#1) from other types of plastics (#2-#6).

**Instructions:** Follow each step carefully and record your results on your ***CRV Chemistry Lab Handout***. To help save time, complete Steps 1-3 and 8-10 as a group. Half the team completes Steps 4-5 while the other half completes Steps 6-7 at the same time.

**How It Works:** Different types of plastics have varying densities, which determine whether they float or sink in liquids of different densities. Many recycling facilities used to rely on water flotation methods to separate plastics from other recyclables. Vegetable oil, isopropyl alcohol, and saltwater can be used to distinguish between plastic types using the density method.

### Step 1: Density Sorting in Deionized Water

❑ Add all 30 plastic samples to the 1000 mL of deionized (DI) water **(Density: 1.0 g/mL)**.

❑ Use the "DI" spoon to **lightly** stir the mixture three times. Remove the spoon and observe for one minute.

❑ Use the "DI" spoon to carefully remove the *floating samples*. Do not disturb the samples that sank until **Step 6**.

### Step 2: Density Sorting in Vegetable Oil

❑ Pat dry the samples that *floated in DI water* (from Step 1) with a paper towel.

❑ Add these samples to the 400 mL of vegetable oil **(Density: 0.92 g/mL)**.

❑ Use the "Oil" spoon to **lightly** stir three times. Remove the stirrer and place it on a paper towel.

❑ Observe for one minute, then use the "Oil" spoon to remove the *floating samples*. Put the spoon on a paper towel.

❑ Wash the samples that floated in oil thoroughly with soap and water, pat dry, and return to the original container. These samples are done.

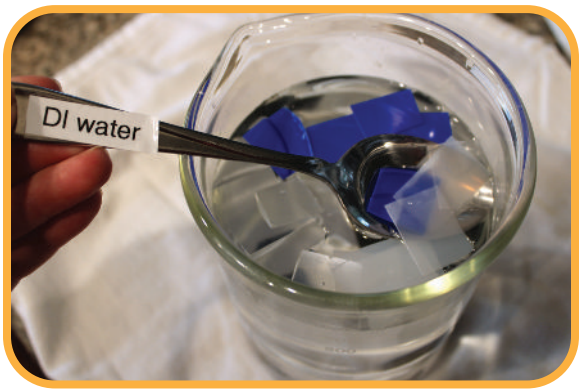
### Step 3: Identify the First Plastic

❑ Use the ***Plastic Identification Dichotomous Key*** to identify the one plastic type that *floats in vegetable oil*.

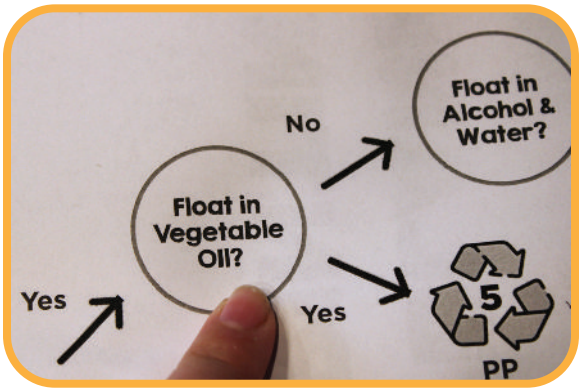
❑ Use the lab handout to record the Recycle Number of the plastic you identified inside the recycling symbol, as well as the Plastic Resin Code.

### Step 4: Density Sorting in Isopropyl Alcohol Solution

❑ Use the "Oil" spoon to remove the samples that *sank in vegetable oil*. Wash them with soap and water, and pat dry.




Use the matching spoon for each step to lightly stir the mixture three times. Using the correctly labeled spoon avoids contamination and maintains the density values for each liquid.



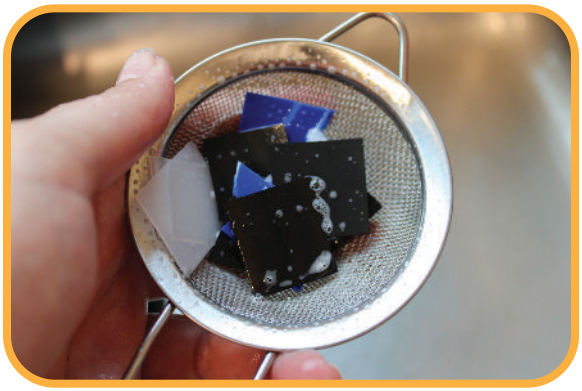

Use the Plastic Identification Dichotomous Key to identify the types of plastic.

❑ Add these samples to the 400 mL of isopropyl alcohol solution **(Density: 0.94 g/mL)**.

❑ Use the "Isopropyl" spoon to **lightly** stir three times. Remove the stirrer and observe for one minute.

❑ Use the "Isopropyl" spoon to remove the *floating samples*. Pat dry and set aside.

**Note:** If both sample types float in the isopropyl solution, add 1 mL of water at a time (to raise the density) until one type sinks. If both sink, add 1 mL of 91% isopropyl alcohol at a time (to lower the density) until one type floats.



Wash oily samples thoroughly with soap and water, and then pat dry.

## Step 5: Identify the Second and Third Plastics

❑ Use the ***Plastic Identification Dichotomous Key*** to identify the one plastic type that *floats in the alcohol solution*, and the one plastic type that s*inks in the alcohol solution*.

❑ Use the lab handout to record the Recycle Number of the plastic you identified inside the recycling symbol, as well as the Plastic Resin Code.

## Step 6: Density Sorting in Saltwater

❑ Remove the samples that *sank in deionized water* (from Step 1). Pat dry with a paper towel.

❑ Add samples to the 400 mL beaker of the saltwater solution **(Density: 1.10 g/mL)**.

❑ Use the "Saltwater" spoon to **lightly** stir the samples three times. Observe for 2–3 minutes.

❑ Use the "Saltwater" spoon to remove the *floating samples*, pat dry, and return to the original container.

## Step 7: Identify the Fourth Plastic

❑ Use the ***Plastic Identification Dichotomous Key*** to identify the one plastic type that *floats in the saltwater solution*.

❑ Use the lab handout to record the Recycle Number of the plastic you identified inside the recycling symbol, as well as the Plastic Resin Code.

**Note:** If three samples types float in the saltwater solution, **lightly stir** in 1 g of table salt at a time (to raise the density) until one type of plastic floats.

## Step 8: Bend Test for Final Samples

❑ Two types of plastic samples should remain after sinking in the saltwater solution. Remove them from the saltwater solution and pat dry.

❑ Perform a "bend test" to differentiate the two remaining samples:

- **PET (#1)** is more flexible and bendable, like a plastic bottle.
- **PVC (#3)** is stiffer and used for rigid products like pipes.

❑ Determine which sample is PET (#1) and show your teacher the correct samples to receive credit for completing this station.

## Clean Up and Reset

❑ Remove, dry, and clean all samples after testing and return them to the starting container.

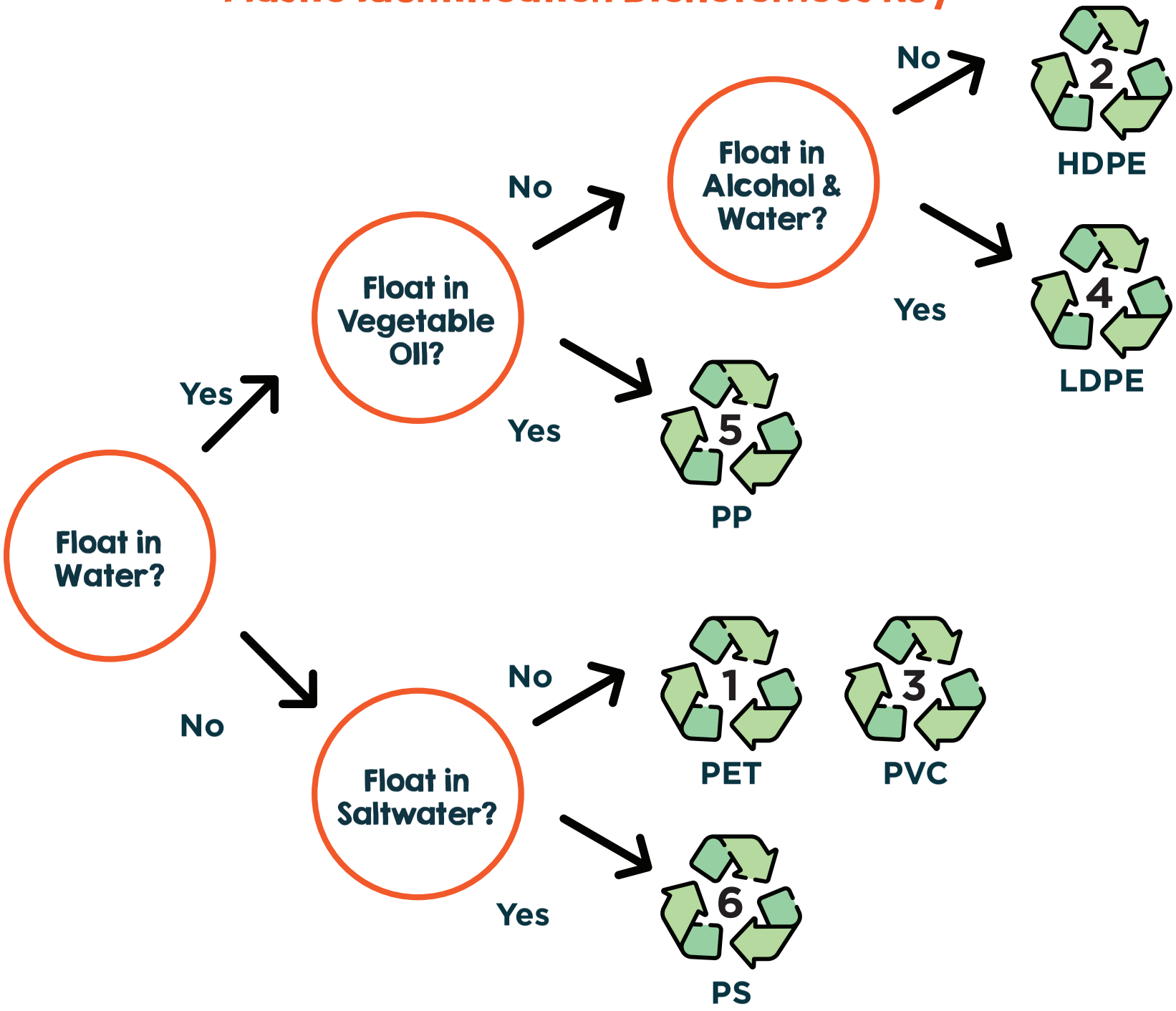
❑ Ensure all materials are prepared for the next group.

## Reflection Questions

❑ Discuss reflection questions from the handout as a group.

❑ Complete the reflection questions for this station on your lab handout.

# Plastic Identification Dichotomous Key



# CRV CHEMISTRY LAB

## STATION #2

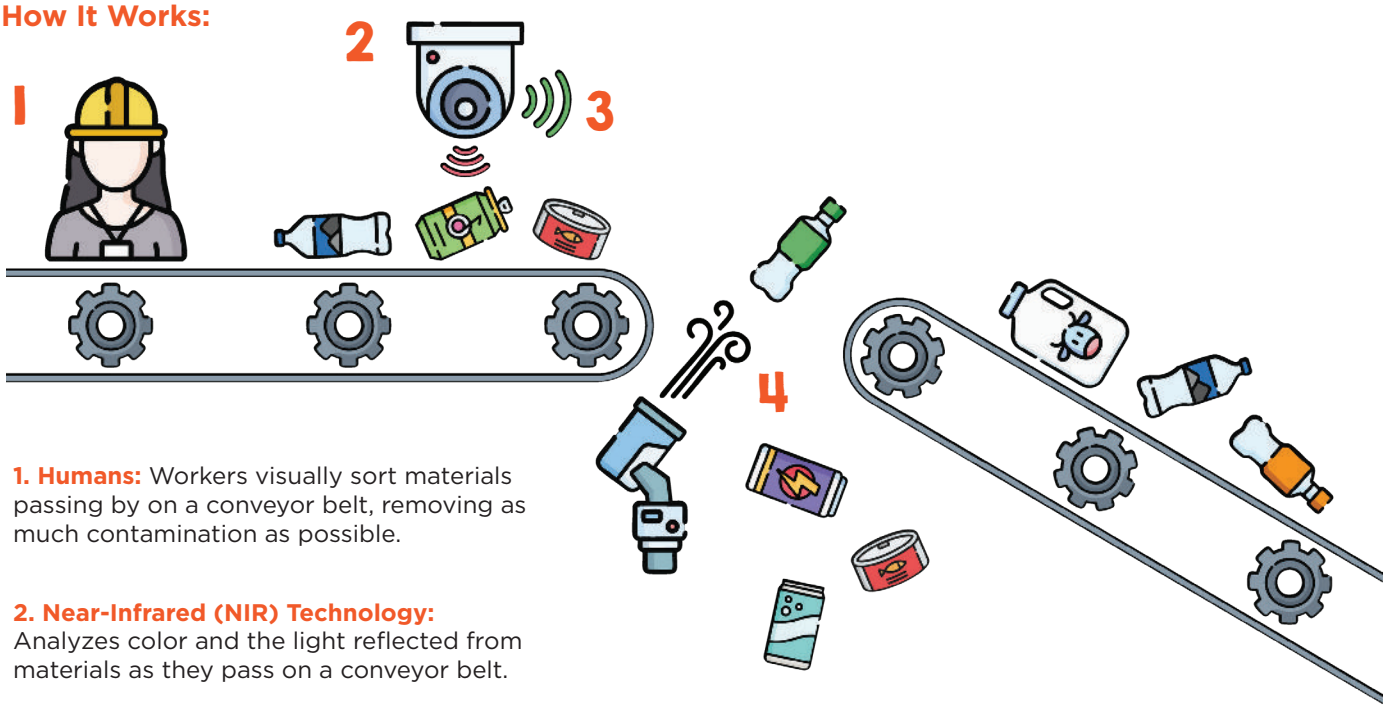
### Optical and Air Sorting

**Time:** 10 minutes

**Objective:** Simulate air and optical sorting systems to understand how technology is used to sort recyclables in a Materials Recovery Facility, or "MRF."

**Instructions:** Follow each step carefully and record your results on your ***CRV Chemistry Lab Handout***.

**How It Works:**




**1. Humans:** Workers visually sort materials passing by on a conveyor belt, removing as much contamination as possible.

**2. Near-Infrared (NIR) Technology:** Analyzes color and the light reflected from materials as they pass on a conveyor belt.

**3. Signal Processing:** Once the NIR identifies a material, it sends a signal to the sorting system about the material's location on the conveyor belt.

**4. Air Jet Sorting:** Based on the signal, high speed air jets blast air at precisely the right time to direct the material to a designated bin or onto another conveyor belt.

## Part I: Manual Sorting Simulation

❑ Put on rubber gloves and aprons. Now you're a MRF employee working the sorting line!

❑ Spread the long paper strip ("conveyor belt") over a 6-foot table and add a binful of waste materials on top.

❑ One person stands at the end of the table and slowly pulls the paper strip across it, simulating a slow conveyor belt.

❑ Two to four people get into position on either side of the table, next to bins labeled for trash, cans or bottles.

Test how efficiently you can sort recyclables.

❑ Start at a slow speed. Each person tries to sort every item into their corresponding bin (trash with trash, cans with cans, bottles with bottles). Record observations about the group's accuracy on the lab handout.

❑ Reset the conveyor belt and the waste items. Repeat the last step at a medium speed. Record observations about the group's accuracy.

❑ Reset again and repeat at a high speed. Record observations.

❑ Complete the accuracy table on the lab handout.

## Part 2: Near-Infrared (NIR) Technology Simulation

❑ Shine both a flashlight and a laser pointer onto different CRV materials and observe how light interacts with each item as well as their surroundings.

❑ Record what you notice for clear plastic, colored plastic, aluminum cans, and other items of your choice on the lab handout.

Simulate NIR technology with a flashlight or carefully with a laser pointer.

## Part 3: Air Jet Simulation

❑ Use the hair dryer (cool setting) to simulate an air jet used for sorting lightweight materials. Take turns aiming the "air jet" at various materials to "push" them onto a target (a piece of colored paper) placed at distances of approximately 2 feet, 4 feet, and then 6 feet away.

❑ Record your observations about air jet accuracy and challenges on the lab handout.

Simulate air jet technology with a hair dryer.

## Clean Up and Reset

❑ Ensure all materials are reset and prepared for the next group.

## Reflection Questions

❑ Discuss reflection questions from the handout as a group.

❑ Complete the reflection questions for this station.

# CRV CHEMISTRY LAB

## STATION #3

### Magnetism and Corrosion of Metals

**Time:** 10 minutes

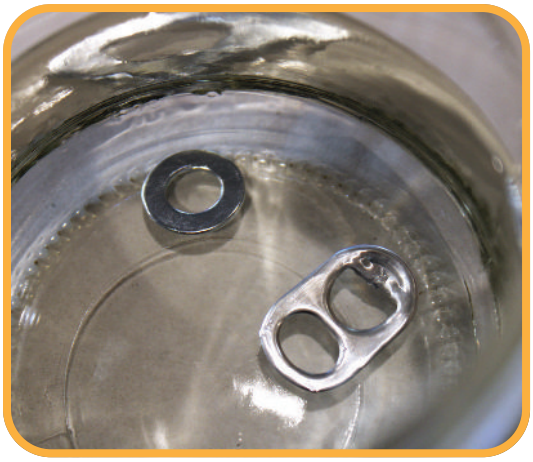
**Objective:** Investigate the magnetic properties and corrosion resistance of aluminum versus steel to understand their recyclability and ease of sorting.

**Instructions:** Follow each step carefully and record your results on your ***CRV Chemistry Lab Handout***.

**How It Works:** Magnetism plays an important role in the waste sorting process, helping to sort recyclables based on their magnetic properties. Corrosion occurs when materials react with substances like water or acids, breaking down over time. Understanding these properties helps recycling facilities efficiently sort and recycle different metals.

## Part I: Corrosion

- ❑ Carefully drop an aluminum can tab and *one of each steel sample* into 200 mL of acetic acid (vinegar).
- ❑ Observe changes to the samples after 1 minute, 5 minutes, and 10 minutes. Record results. **Complete Part 2 while you wait.**
- ❑ Remove the samples from the acetic acid using tweezers, rinse with water, and return to the starting container.



Test how steel and aluminum interact with acetic acid.

## Part 2: Magnetism

- ❑ Use one magnet to pick up as many steel samples as possible.
- ❑ Remove the steel samples and weigh them on a scale (in grams). Tare the starting weight for any containers used to weigh the samples.
- ❑ Record the weight of the steel samples on the lab handout.
- ❑ Weigh the aluminum can (in grams). Record the weight on the lab handout.
- ❑ Use the magnet to pick up the aluminum can. Record the results.


Compare the magnetic properties o different metals.

## Clean Up and Reset

- ❑ Use the tweezers to remove the samples from the acetic acid. Rinse both with water and pat dry.
- ❑ Ensure all materials are reset and prepared for the next group.

## Reflection Questions

- ❑ Discuss reflection questions from the handout as a group.
- ❑ Complete the reflection questions for this station.

# CRV CHEMISTRY LAB

## STATION #4

### Glass Composition and Behavior of Light

**Time:** 10 minutes

**Objective:** Explore how the composition and color of glass affect its recyclability and ease of sorting.

**Instructions:** Follow each step carefully and record your results on your ***CRV Chemistry Lab Handout***. For safety reasons, no actual glass will be used in this lab.

**How It Works:** Glass is primarily composed of silicon dioxide ($SiO_2$). When recycled, it is crushed into cullets, melted, and reshaped into new products.

Glass color is altered by adding metal oxides and compounds—for example, iron oxide ($Fe_2O_3$) and chromium oxide ($Cr_2O_3$) create green glass, while carbon and sulfur compounds produce brown glass. These additives not only affect color but also impact glass density, light bending, and dispersion. While color changes can be for aesthetic appeal, they primarily serve a functional purpose—protecting the contents from light and heat to prevent spoilage.

## Part I: Refractive Index

A material's refractive index (RI) determines how much light bends as it enters a material, and how much it spreads as it exits. In this experiment, observe how light behaves when it passes through two mediums: water or vegetable oil, each of which is being used to represent clear glass (water) or colored glass (oil). Note the difference in the RI of each medium:

| Medium | Refractive Index (RI) | Glass Represented |
|---|---|---|
| Water | 1.33 | **Clear Glass** |
| Vegetable Oil | 1.47 | **Colored Glass** |

❑ Place the two filled beakers (one with water, one with vegetable oil) exactly 1 foot away from a smooth, vertical surface. Use a ruler to measure the distance from the vertical surface to the front of the beakers.

❑ Shine an LED flashlight directly through the side of each beaker, projecting the light beam onto the vertical surface. Hold the flashlight so that its top remains below the liquid level in the beaker.

❑ Compare the width of the light beams on the vertical surface by measuring the width (spread) of each beam with a ruler. Record the measurements on the handout.

Test the refractive index (RI) of different mediums.

## Part 2: Mixing "Glass"

❑ Shine the flashlight down over white paper. Add one of the color paddles under the light. Observe the color that projects onto the paper. Repeat for the different color paddles.

❑ Now layer two differently colored squares together (green + yellow, blue + green, etc.) and shine the flashlight through them onto the paper.

❑ Record your observations on the handout.

Test what happens when "glass" of different colors are mixed together.

## Part 3: Glass Contamination Sorting

❑ Mix transparent beads of all colors in a single container. Each bead represents a glass "cullet".

❑ Take turns attempting to sort out all of the colors into separate containers with a time limit of 30 seconds each. Record how many beads you were able to correctly sort and determine the winner.

❑ Discuss how contamination reduces the quality of recycled glass products and the difficulty of manual sorting.

Evaluate the efficiency of sorting mixed glass cullets.

## Clean Up and Reset

❑ Ensure all materials are reset and prepared for the next group.

## Reflection Questions

❑ Discuss reflection questions from the handout as a group.

❑ Complete the reflection questions for this station.

# CRV Chemistry Lab - Student Handout

**Name:** _____ **Teacher:** _____ **Date:** _____

**Objective:** In this lab, you will investigate the physical and chemical properties of CRV (California Redemption Value) materials, including plastics, metals, and glass. By conducting experiments, you'll gain a deeper understanding of recycling processes and apply your findings to plan a conceptual design for a modern ***Material Recovery Facility (MRF)***.

**Instructions:** You will rotate with a small group through four stations for ~10 minutes each. Record your observations and reflections in this handout as you go and complete any missing information at the end. Each station focuses on specific properties of recyclable materials:

- **Station 1:** *Density of Plastics*
- **Station 2:** *Air and Optical Sorting*
- **Station 3:** *Magnetism and Corrosion of Metals*
- **Station 4:** *Glass Composition and Light Refraction*

**Follow the instructions carefully, including safety guidelines!**

## Station I: Density of Plastics

### I. Density Test Results

Write the Recycling Code (#1-6) in the recycling symbol (♺) and then the Plastic Resin Code.

| Floats in Vegetable Oil | Floats in Alcohol | Sinks in Alcohol | Floats in Saltwater | Sinks in Saltwater |
|---|---|---|---|---|
| ♺ | ♺ | ♺ | ♺ | ♺ |
| Plastic Resin Code: | Plastic Resin Code: | Plastic Resin Code: | Plastic Resin Code: | Plastic Resin Code: |

### 2. Reflection Questions

How could float density tests help MRFs separate different types of plastics? Why is proper sorting of plastics important?

If MRFs had to use float tests to sort thousands of pounds of plastic every day, what challenges might they face? What ideas do you have to improve cost and efficiency?

Follow the instructions carefully, including safety guidelines!

# Station 2: Optical and Air Sorting

## 1. Observations and Results

### **Part 1:** Manual Sorting Simulation - Accuracy

Estimate your percent accuracy at removing recyclables at each "conveyor belt" speed.

| Slow | % | Medium | % | High | % |
|---|---|---|---|---|---|

### **Part 1:** N.I.R. Simulation

Record observations for how light interacts with each type of recyclable.

| | Clear Plastic | Colored Plastic | Aluminum | Other |
|---|---|---|---|---|
| Observations | | | | |

### **Part 3:** Air Jet Simulation

Estimate your percent accuracy in "air blasting" recyclables to the target at each distance.

| 2 Feet | % | 4 Feet | % | 6 Feet | % |
|---|---|---|---|---|---|

## 2. Reflection Questions

Which do you think is faster and more accurate at sorting recyclables—machines or humans? Why might one be better than the other in a Material Recovery Facility (MRF), or are both equally important?

What problems might arise when sorting tricky items like plastic bags, lightweight trash, or containers that still have food in them? How could these items cause issues in the sorting process?

**Follow the instructions carefully, including safety guidelines!**

# Station 3: Metal Magnetism and Corrosion

## I. Observations and Results

### Part 1: Corrosion

Record your observations for each type of metal in the specified timeframe.

| | 1 Minute | 5 Minutes | 10 Minutes |
|---|---|---|---|
| **Aluminum** | | | |
| **Steel** | Pre-treated:<br><br>Untreated: | Pre-treated:<br><br>Untreated: | Pre-treated:<br><br>Untreated: |

### Part 2: Magnetism

**A)** How many grams of steel did the single magnet hold? How many grams of aluminum?

| **Steel** | in grams | **Aluminum** | in grams |
|---|---|---|---|

**B)** Is aluminum magnetic?

❑ Yes ❑ No

**C)** Describe how magnets interact with aluminum.

_____

_____

## 2. Reflection Questions

How can magnets be used to help separate metals in a Materials Recovery Facility (MRF)?

Why might aluminum's ability to resist rust and corrosion make it easier to recycle than steel?

Follow the instructions carefully, including safety guidelines!

# Station 4: Glass Composition and Light Refraction

## I. Observations and Results

### **Part 1:** Refractive Index (RI)

How do you predict light will bend and spread differently between two materials with different refractive indices? How might this relate to glass color?

| "Glass" | Observations | Beam Width (in cm) |
|---|---|---|
| **Clear** | | |
| **With Color** | | |

How does your prediction compare to your observations? What did you learn about refractive indices of differently colored glass?

### **Part 2:** Mixing Glass

| Color Combination (Write In) | Observations |
|---|---|
| + | |
| + | |
| + | |

Summarize what happens when "glass" colors are mixed together.

**Part 3:** Glass Contamination Sorting

| Sorter's Name | # of Bead "Glass Cullets" Properly Sorted in 30 Seconds |
|---|---|
| | |
| | |
| | |

## 2. Reflection Questions

Why do Material Recovery Facilities (MRFs) or glass manufacturers need to sort glass by color? What happens to the glass product if different colors are mixed together?

How does technology, like optical sorting machines, help recycle glass more efficiently?

Do you think glass should be sorted before it is cut into cullets, or after? Explain your reasoning.

# Design Your Own Yolo Material Recovery Facility

**Every day, Yolo County residents and businesses toss all their recyclables (and sometimes non-recyclables) into the same bin. These bins are picked up by garbage trucks and taken to a Material Recovery Facility (MRF), where everything arrives completely mixed up—including trash that shouldn't be there. Each week, hundreds of tons of materials are dumped at the MRF, and it's up to the facility to sort out aluminum cans, glass bottles, and different types of plastic while keeping contamination low.**

***Your challenge?*** **Design a recycling facility that sorts materials quickly, accurately, and with as little contamination as possible!**

The current MRF process begins with sorting by hand.

## Instructions

Using what you've learned from the **CRV Chemistry Lab**, plan and design a **MRF** that efficiently sorts:


**Aluminum cans**


**Glass bottles by color**


**Different types of plastic**

Think about how to **reduce contamination** (like trash mixed in with recyclables) and keep your system **fast and accurate**.

## Considerations:

- How do you remove trash and non-recyclables first?
- Which recyclable should be sorted first? Why?
- What machines or tools would you need?
- How do you make your system both fast and accurate?
- How can you stop glass or plastic from getting mixed up?
- What role do people play in the sorting process?

## Planning Space

In the space below write your answers to the questions above. Then, plan your recycling facility by:


**Writing an outline of your sorting process** ***OR***


**Sketching and labeling a diagram of your facility**

Make sure your design is **realistic, creative, and solves the problem efficiently**!

GRADES
K-12

# Bringing It Home

## Give students a first-hand look at the waste opportunities in their school!

These hands-on, real-life experiences empower students to identify and sort waste properly, calculate waste reduction opportunities, and share their findings with their community. By involving students of all ages and encouraging cross-grade collaboration, these activities promote environmental stewardship, critical thinking, and teamwork.

### Students will be able to:

- Conduct a waste audit to classify and measure various types of waste, including CRV items
- Apply mathematical skills to calculate waste reduction trends and opportunities
- Raise funds for their school or a special project
- Develop and implement an action plan to improve their school's waste practices

### Unit Pre-Requisites:

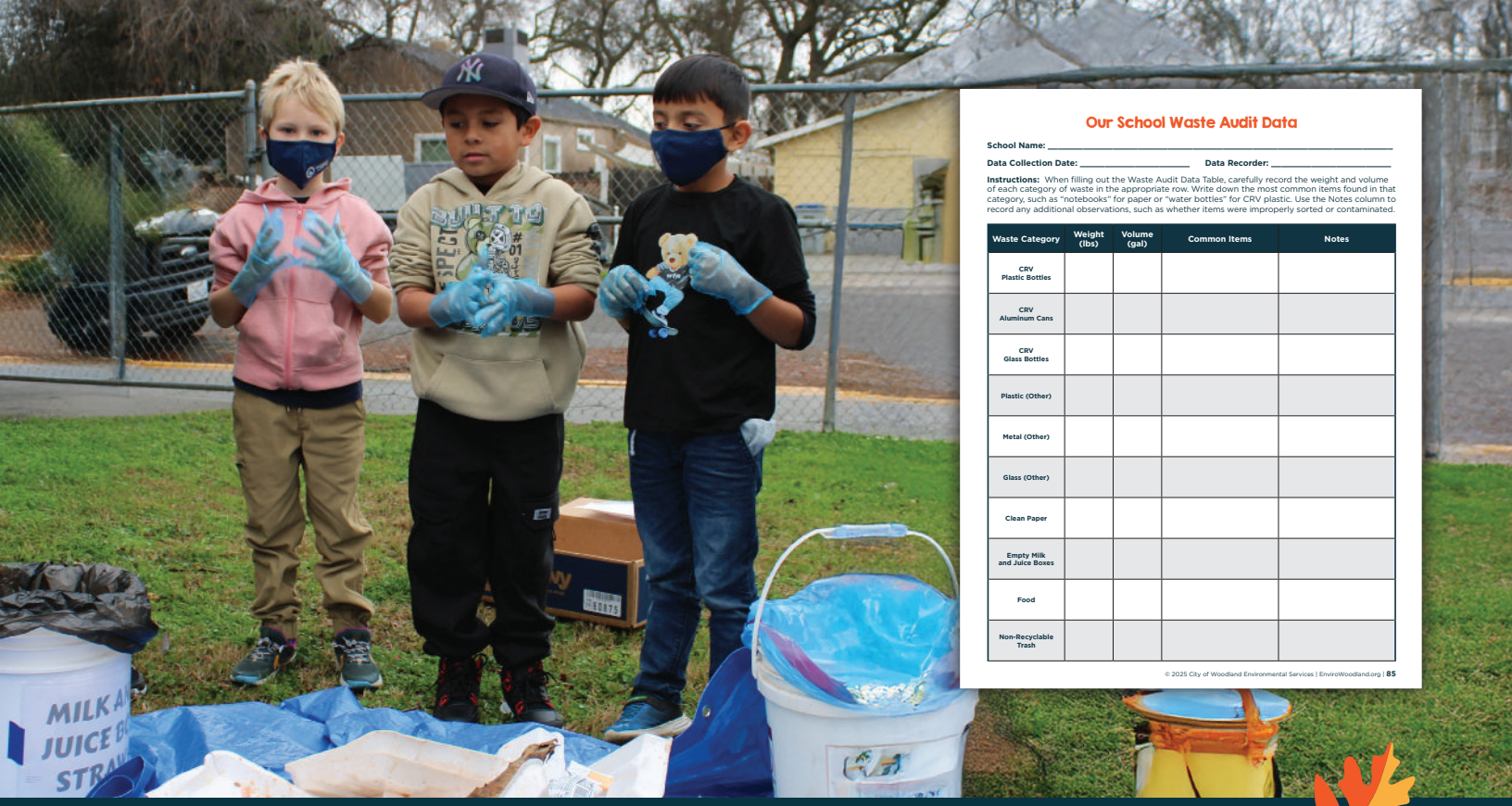
- Familiarity with basic sorting concepts, such as grouping by type, size, or category
- Understanding of terms such as "recycling," "composting," "trash," and "CRV"
- Ability to recognize and name common recyclable and waste items encountered in daily life

### Note to Educators:

These activities are suitable for all age groups, from kindergarten to high school. To accommodate the diverse range of students, curriculum-specific connections have been omitted to maintain flexibility in implementation.

For enhanced learning and teamwork, older students can partner with younger students or divide tasks, such as conducting calculations, sorting waste, or presenting findings. This cross-grade collaboration fosters mentorship and maximizes engagement.

Encourage students to share their waste audit results and CRV recycling efforts with the entire school community, reinforcing the message of environmental stewardship and collective responsibility. Take it one step further by sharing results with student families and caregivers.



### Our School Waste Audit Data

**School Name:** _____

**Data Collection Date:** _____ **Data Recorder:** _____

**Instructions:** When filling out the Waste Audit Data Table, carefully record the weight and volume of each category of waste in the appropriate row. Write down the most common items found in that category, such as "notebooks" for paper or "water bottles" for CRV plastic. Use the Notes column to record any additional observations, such as whether items were improperly sorted or contaminated.

| Waste Category | Weight (lbs) | Volume (gal) | Common Items | Notes |
|---|---|---|---|---|
| CRV Plastic Bottles | | | | |
| CRV Aluminum Cans | | | | |
| CRV Glass Bottles | | | | |
| Plastic (Other) | | | | |
| Metal (Other) | | | | |
| Glass (Other) | | | | |
| Clean Paper | | | | |
| Empty Milk and Juice Boxes | | | | |
| Food | | | | |
| Non-Recyclable Trash | | | | |



# School Waste Audit

Students and staff understand their school's waste generation and improve waste management practices by identifying opportunities to reduce, reuse, and recycle.

**Time Required:** 2-3 hours

## 1. Plan the Audit

- **Set a Date:** Choose a time when waste generation is representative, such as after lunch.
- **Form a Team:** Include students, staff, and volunteers.
- **Communicate:** Inform all stakeholders about the purpose and plan.

## 2. Prepare the Area

- Lay down the tarp in a well-ventilated, flat outdoor or indoor area.
- Ensure participants wear gloves and follow safety protocols.

### Materials Needed:

- Large tarps or washable ground cover
- Rubber gloves (one pair per participant)
- Clear plastic bags for sorting waste categories
- Permanent markers and labels
- Clipboards, pens, and worksheets for data recording
- Bathroom scale or portable hanging scale
- Designated organics, trash, and recycle bins (for re-bagging sorted waste)
- Hand sanitizer
- Tongs/grabbers (optional)
- Safety goggles (optional)
- Face masks (optional)

## 3. Collect Waste Samples

- Gather a day's worth of trash from selected bins (examples: cafeteria, classrooms, playground).
- Label the bags by location (examples: Cafeteria, Classroom 1, Library, Kitchen).

## 4. Sort the Waste

- Open one bag at a time and sort items into categories listed on the ***Our School Waste Data*** handout.
- Use clear bags for each category to keep items visible or label bags/sorting areas accordingly.

## 5. Record Data

- Weigh (pounds) and measure volume (gallons) for each category, recording data on the data handout.
- Note observations, such as contamination in recycling bins or common waste items.

## 6. Analyze Results

- Summarize findings with the team and identify areas to improve waste sorting and reduction efforts.

Students sorting waste as part of an audit.

## 7. Reassemble and Dispose

- Bag sorted waste for proper disposal, composting, or recycling.
- Clean the area and ensure all participants sanitize hands.

## 8. Take Action

- Students process data (calculate percentages, trends) and share results with students and staff.
- Develop an action plan to improve waste management (examples: new signage, student training).

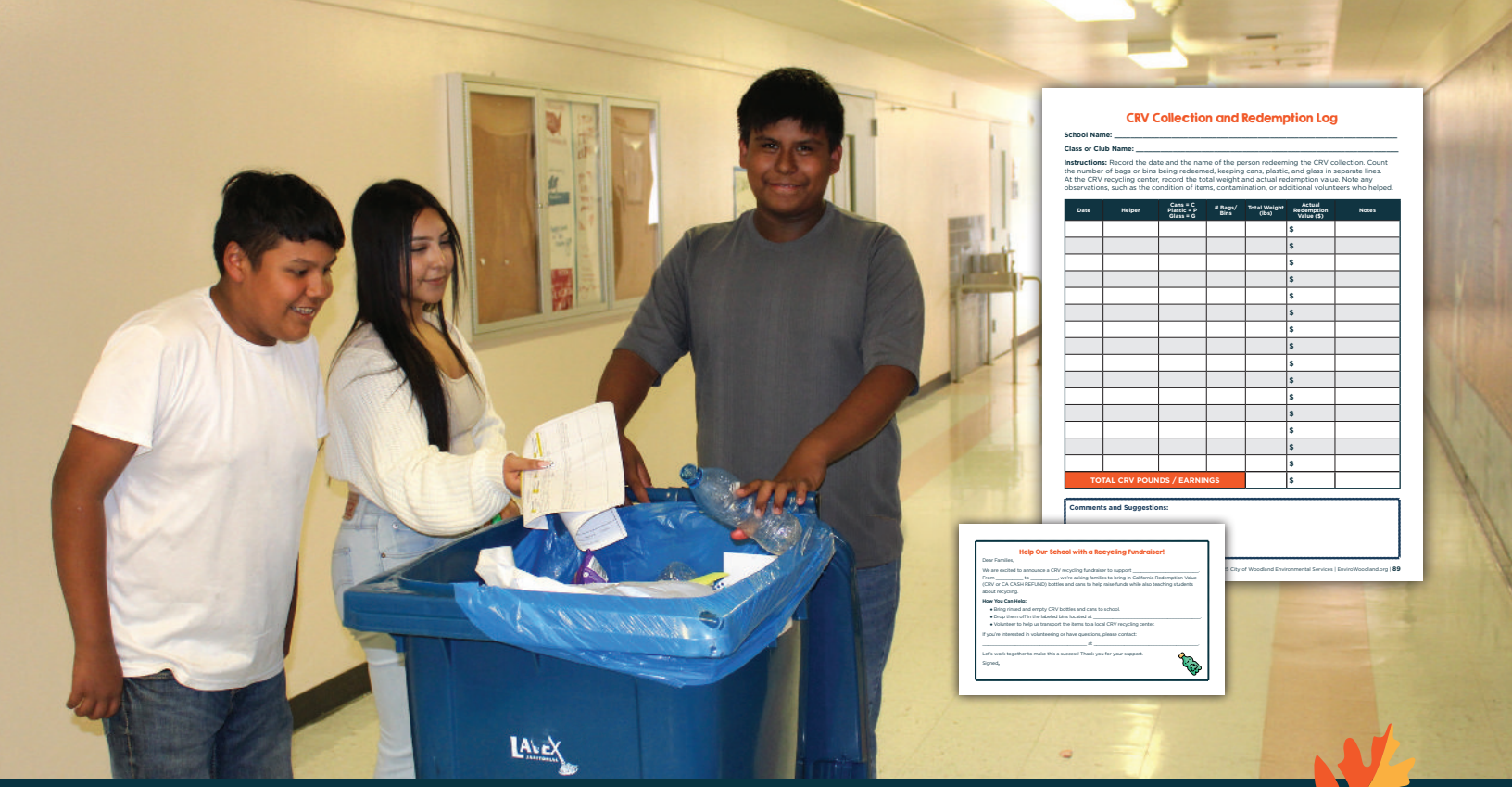
# Our School Waste Audit Data

**School Name:** _____

**Data Collection Date:** _____ **Data Recorder:** _____

**Instructions:** When filling out the Waste Audit Data Table, carefully record the weight and volume of each category of waste in the appropriate row. Write down the most common items found in that category, such as “notebooks” for paper or “water bottles” for CRV plastic. Use the Notes column to record any additional observations, such as whether items were improperly sorted or contaminated.

| Waste Category | Weight (lbs) | Volume (gal) | Common Items | Notes |
|---|---|---|---|---|
| CRV Plastic Bottles | | | | |
| CRV Aluminum Cans | | | | |
| CRV Glass Bottles | | | | |
| Plastic (Other) | | | | |
| Metal (Other) | | | | |
| Glass (Other) | | | | |
| Clean Paper | | | | |
| Empty Milk and Juice Boxes | | | | |
| Food | | | | |
| Non-Recyclable Trash | | | | |




# CRV Recycling Fundraiser

Students learn about the life cycles of waste and how recycling and composting saves resources.

**Time Required:** 1-2 weeks

## I. Plan the Fundraiser

- **Set Dates:** Choose a 1-2 week period for collections.
- **Secure Volunteers:** Recruit parents, teachers, or older students to assist with collection and transportation. Engage your school PTA/PTO.
- **Coordinate Redemption:** Locate the nearest CRV recycling center and confirm logistics for drop-offs of larger volumes of material.
- **Select Fundraising Goal:** Choose a fundraising goal and what will be done with the funds (donate to charity, class party, pay for a presenter or field trip).

### Materials Needed:

- Handout: ***CRV Fundraiser Family Letter***
- Handout: ***CRV Collection/Redemption Log***
- Student/adult volunteer signup method
- CRV redemption schedule
- Fundraiser posters or flyers
- 32 gallon bins or transparent bags
- 13 gallon trash bags for contamination
- 5 gallon bucket for liquid contamination
- Drop off instruction signs
- Large transport bins or bags
- Gloves
- Clipboard and pens
- Aprons (optional)
- Scale (optional)

## 2. Promote the Event

- Fill in the blanks of the ***CRV Fundraiser Family Letter***, make copies, and send it home to student families.
- Use school communication channels to spread the word.

## 3. Set Up Collection Points

- Choose a visible, convenient location for families to drop off items (example: near the school's main entrance or in an accessible classroom or multipurpose room).
- Clearly label bins or collection bags for CRV bottles and cans with rules (example: empty cans and bottles only, lids and caps attached) and fundraising goals.

## 4. Organize Drop-Offs

- Schedule regular redemption dates to avoid overflowing bins.
- Track the amount collected using the ***CRV Collection and Redemption Log*** until the fundraiser has concluded.

## 5. Celebrate and Share Results

- Announce the total funds raised and thank participants.
- Highlight how funds will be used to benefit the school or community.

# CRV Collection and Redemption Log

**School Name:** _____

**Class or Club Name:** _____

**Instructions:** Record the date and the name of the person redeeming the CRV collection. Count the number of bags or bins being redeemed, keeping cans, plastic, and glass in separate lines. At the CRV recycling center, record the total weight and actual redemption value. Note any observations, such as the condition of items, contamination, or additional volunteers who helped.

| Date | Helper | Cans = C<br>Plastic = P<br>Glass = G | # Bags/ Bins | Total Weight (lbs) | Actual Redemption Value ($) | Notes |
|---|---|---|---|---|---|---|
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| | | | | | $ | |
| **TOTAL CRV POUNDS / EARNINGS** | | | | | $ | |

**Comments and Suggestions:**

## Help Our School with a Recycling Fundraiser!

Dear Families,

We are excited to announce a CRV recycling fundraiser to support _____. From _____ to _____, we're asking families to bring in California Redemption Value (CRV or CA CASH REFUND) bottles and cans to help raise funds while also teaching students about recycling.

**How You Can Help:**

- Bring rinsed and empty CRV bottles and cans to school.
- Drop them off in the labeled bins located at _____.
- Volunteer to help us transport the items to a local CRV recycling center.

If you're interested in volunteering or have questions, please contact:

_____ at _____.

Let's work together to make this a success! Thank you for your support.

Signed,


## Help Our School with a Recycling Fundraiser!

Dear Families,

We are excited to announce a CRV recycling fundraiser to support _____. From _____ to _____, we're asking families to bring in California Redemption Value (CRV or CA CASH REFUND) bottles and cans to help raise funds while also teaching students about recycling.

**How You Can Help:**

- Bring rinsed and empty CRV bottles and cans to school.
- Drop them off in the labeled bins located at _____.
- Volunteer to help us transport the items to a local CRV recycling center.

If you're interested in volunteering or have questions, please contact:

_____ at _____.

Let's work together to make this a success! Thank you for your support.

Signed,


## ¡Ayude a nuestra escuela con una recaudación de fondos con el reciclaje!

Queridas familias,

Estamos emocionados anunciar una recaudación de fondos con el reciclaje de CRV para apoyar a _____. Del _____ a _____, les pedimos a las familias que traigan botellas y latas de California Redemption Value (CRV o CA CASH REFUND) para ayudar a recaudar fondos y, al mismo tiempo, enseñarles a los estudiantes sobre el reciclaje.

**Cómo puede ayudar:**

- Traiga botellas y latas de CRV enjuagadas y vacías a la escuela.
- Déjelos en los contenedores etiquetados, ubicados en _____.
- Ofrézcase como voluntario para ayudarnos a transportar los artículos a un centro de reciclaje de CRV local.

Si está interesado en ser voluntario o tiene preguntas, comuníquese con:

_____ en _____.

¡Trabajemos juntos para que esto sea un éxito! Gracias por su apoyo.

Firmado,


## ¡Ayude a nuestra escuela con una recaudación de fondos con el reciclaje!

Queridas familias,

Estamos emocionados anunciar una recaudación de fondos con el reciclaje de CRV para apoyar a _____. Del _____ a _____, les pedimos a las familias que traigan botellas y latas de California Redemption Value (CRV o CA CASH REFUND) para ayudar a recaudar fondos y, al mismo tiempo, enseñarles a los estudiantes sobre el reciclaje.

**Cómo puede ayudar:**

- Traiga botellas y latas de CRV enjuagadas y vacías a la escuela.
- Déjelos en los contenedores etiquetados, ubicados en _____.
- Ofrézcase como voluntario para ayudarnos a transportar los artículos a un centro de reciclaje de CRV local.

Si está interesado en ser voluntario o tiene preguntas, comuníquese con:

_____ en _____.

¡Trabajemos juntos para que esto sea un éxito! Gracias por su apoyo.

Firmado,

# Glossary

**California Redemption Value (CRV):** A deposit-refund system in California requiring consumers to pay a small deposit (5, 10 or 25 cents per container) when purchasing beverages. The deposit is refunded when the container is returned to a CRV Recycling Center.

**Chemical Properties:** Characteristics of materials that define their chemical composition and reactions, such as flammability or reactivity, and their ability to be recycled.

**Composting:** The process of breaking down organic materials, such as food scraps and yard waste, into nutrient-rich soil through natural decomposition.

**Contamination:** The presence of non-recyclable or incorrect materials in recycling or compost bins, which can reduce the quality and recyclability of collected items.

**Corrosion**: The process by which metals degrade due to chemical reactions with their environment; understanding corrosion helps assess recyclability.

**Cullet:** A term for crushed, recycled glass that is cleaned and sorted by color and size, then melted down to make new glass products.

**Decomposition:** The natural breakdown of organic materials by micro- and macro-organisms, resulting in compost or other natural byproducts.

**Density:** A physical property of matter representing mass per unit volume, used in recycling to separate materials like plastics.

**Eddy Currents:** Create a repelling force in aluminum when exposed to a changing magnetic field, allowing it to be separated from other materials.

**Food Waste:** Organic waste generated from food preparation, leftovers, or spoiled food that can often be composted.

**Landfill:** A site designated for the disposal of waste materials, where trash is buried and managed to minimize environmental impacts.

**Magnetism:** A property of materials that causes them to attract or repel other materials; used in recycling to separate ferrous metals (like steel) from non-ferrous metals (like aluminum).

**Material Recovery Facility (MRF):** A specialized plant where recyclable materials are sorted, cleaned, and prepared for recycling into new products.

**Mind Map:** A visual diagram that organizes ideas, concepts, or information around a theme.

**Non-Recyclable Items:** Materials that cannot be processed through standard recycling systems, such as certain plastics, food wrappers, or contaminated items.

**Optical Sorting:** A method in recycling where sensors detect and sort materials based on their optical properties, such as color or type of resin.

**Organic Waste:** Biodegradable waste derived from living organisms, including food scraps, yard waste, and agricultural residues, which should be composted instead of landfilled.

**Physical Properties:** Observable and measurable characteristics of materials, such as density, color, or hardness, used to sort recyclables.

**Plastic Type or Plastic Resin Identification Code:** A numbered code, typically found within the recycling symbol on plastic products, used to identify the type of plastic for recycling purposes.

**Recyclability:** The potential for a material to be processed and reused in the production of new products.

**Recycling:** The process of converting waste materials into new products to reduce resource consumption and waste.

**Recycling Symbol (♺):** A universal symbol indicating that a product or material can be recycled, often accompanied by a recycle number code 1 through 6 and a Plastic Resin Code (PET, HDPE, PVC, LDPE, PP, or PS, respectively).

**Refraction Index:** A number describing the bending and divergence of light as it passes through materials of different densities, used to identify and sort glass types in recycling.

**Reverse Vending Machines (RVMs):** Machines where individuals can deposit recyclable containers, such as bottles and cans, often in exchange for refunds or incentives.

**Single-Stream Recycling:** A recycling system where all recyclable materials are placed in the same bin for collection and sorted at a Material Recovery Facility (MRF).

**Upcycling:** The process of creatively reusing waste products to create new, higher-quality or more functional items.

**Waste Audit:** A systematic assessment of waste generation and composition within a specific area, such as a school or workplace, to identify opportunities for waste reduction, recycling, and composting.

**Waste Diversion:** The process of redirecting waste from landfills through recycling, composting, or reuse programs.

**Yolo County Central Landfill:** The local landfill serving Yolo County, where trash is managed and buried following environmental regulations.

# Teacher Lesson Notes, Ideas, and Reminders

# Teacher Lesson Notes, Ideas, and Reminders

Funded By CalRecycle

**City of Woodland**
**Environmental Services**
300 First Street
Woodland, CA 95695
(530) 661-5800
EnviroWoodland@cityofwoodland.gov

**Aligned to California Common Core and Next Generation Science Standards**