AVID Summer Bridge

Curriculum Sampler

summerbridge@avid.org

AVID Science
Summer Bridge Program

MISSION POSSIBLE

Middle School Science

AVID Center

TABLE OF CONTENTS

UNIT 9:
CASABLANCA, MOROCCO
HEAT AND TEMPERATURE

Objectives: The Students Will...

- Compare temperature scales (ºF and ºC), and convert between the scales.
- Investigate endothermic and exothermic chemical and physical changes.
- Measure and graph temperature changes.
- Be familiar with the concept of specific heat and relate it to climate.

Activities

- *Podcast on the Mission* (15 min)
- *Hot or Cold?* (60 min)
- *Brain Break: Group Matching* (5 min)
- *Feet in the Sand* (90 min)
- *Reflection: Postcard from Morocco* (15 min)
- *Temperature Conversions* (20 min)
- *Vocabulary Charades* (15 min)
- *Podcast, Unit 9: Latitude and Longitude* (10 min)

Handouts

- *Hot or Cold? Lab*
- *Hot or Cold? Stations Directions* (1 set per class)*
- *Feet in the Sand Lab*
- *Feet in the Sand Graph*
- *Temperature Conversions: Cornell Notes*

Resources and Supplies

Markers, highlighters, pencils, scissors, sticky notes, glue sticks, adhesive tape, colored pencils, computer, speakers, and document camera

- Calculators, 4-function (1 per agent)
- 5" x 7" index cards (1 per agent)
- 3" x 5" index cards (16 per class)
- Stickers

Hot or Cold?

- Lab safety goggles (1 per agent)
- Lab aprons (1 per agent)
- Candle, with holder (1 per class)
- Matches or lighter (1 per class)
- Cups or beakers, 250 mL (6 per class)
- Graduated cylinders, 25 or 50 mL (6 per class)
- Thermometers (6 per class)
- Dry laundry detergent (1 cup per class)
- Teaspoons (5 per class)
- Water (100 mL)
- Baking soda (~500 g)
- Fruit juice, orange or lemon (500 mL)
- Calcium chloride or DampRid® (~250 g)
- Cabbage juice, left over from Unit 5 (250 mL)
- Ice, cubed or crushed (~500 mL)
- Dry yeast powder (~100 mL)
- Hydrogen peroxide, 3% (500 mL)
- Vinegar, 5% (500 mL)

Feet in the Sand

- Sand (~200 g per group)
- Water (~200 mL per group)
- Thermometers (2 per group)
- Timing devices (1 per group)★
- Graduated cylinders, 100 mL (1 per group)
- 5" x 7" index cards (1 per group)
- Beakers, 250 mL (2 per group)
- Rulers (1 per group)
- Heat lamp (use only if needed; 2 per class)
- Balances (3–4 per class)
- Masking tape
- Colored pencils and markers
- Plastic wrap (optional)
- White copy paper or chart/butcher paper (1 sheet per group)
- Stickers

Teacher Preparation

- Prepare red cabbage juice (250 mL) or use the remainder from Unit 5.
- Set up lab supplies for stations in *Hot or Cold?*
- Locate an area outside the school to leave beakers out during *Feet in the Sand.*
- Prepare the *Vocabulary Charades* cards.
- Cut the "Heat Transfer Certified" squad badges for Unit 9.

WICOR Strategies

W - Take notes and write summaries and conclusions
I - Make predictions; prepare and analyze graphs
C - Participate in group vocabulary activities
O - Plan and organize using note-taking and Interactive Notebooks
R - Interpret and analyze data and graphs

Correlation to Next Generation Science Standards

Disciplinary Core Ideas and Performance Expectations

- PS1.A: Structure and Properties of Matter (PE: MS-PS1-2)
- PS1.B: Chemical Reactions (PE: MS-PS1-2)
- PS3.A: Definitions of Energy (PE: MS-PS1-4)
- PS3.B: Conservation of Energy and Energy Transfer (PE: MS-PS3-5)

Science and Engineering Practices

- Planning and Carrying Out Investigations
- Constructing Explanations
- Analyzing and Interpreting Data

New Vocabulary

- chemical change
- joule
- physical change
- specific heat

Mission Processing Assignment

INTRODUCTION

Headquarters has a suspect, Mono, one of the henchmen who works for Dr. Vicious. The Interpol agents' mission is to discreetly get his information about Dr. Vicious. In order to do this, they must calculate the time they need to leave their hotel in order to intercept the suspect as he passes underneath the Wellington Arch. They must meet him at the exact time he passes underneath the arch so that they do not draw attention!

time

25 minutes

handout

- *Mission Processing Assignment*

supplies

- Calculators (1 per group)
- Treats or prizes such as stickers (optional)*

Teacher Directions

- For this processing assignment, agents will determine an exact time that they must leave their hotel in order to intercept the suspect, Mono, to receive his message about Dr. Vicious. They are given the speeds and starting locations for themselves and the henchman.
- This activity should be done in small groups in order to combine the reasoning of several agents. They must combine the knowledge and skills they have learned about measurement and speed and think critically to solve the problem.
- Have agents locate the *Mission Processing Assignment* sheet (Case File page 30). Below is information that is needed to solve the problem.
    - Mono will arrive on a subway train at 6:00 p.m. and begin walking toward Wellington Arch, which is 390 meters from where he steps off the train.
    - Mono's walking speed is 130 meters/minute.
    - The Interpol agents' hotel is 480 meters from Wellington Arch.
    - The Interpol agents' walking speed is 120 meters/minute.
- Allow the agents 3–4 minutes to brainstorm how to solve the problem (Case File page 30). Then ask them to record all calculations they use to find the time they must leave the hotel. Tell them they will get an extra prize if they use the dimensional analysis process in solving the problem.
- Give a small treat or prize to each group that determines the correct answer (e.g., give stickers to the agents to be placed on their squad posters).

Mission Processing Assignment

Calculate the time you and the other agents need to leave the hotel in order to intercept the suspect, Mono, as he passes underneath the Wellington Arch. You must meet him at the exact time he passes underneath the arch so that you do not draw attention. Below is information you will need to solve the problem.

- Mono will arrive on a subway train at 6:00 p.m. and begin walking toward Wellington Arch, which is 390 meters from where he steps off the train.
- Mono's walking speed is 130 meters/minute.
- Your hotel is 480 meters from Wellington Arch.
- Your walking speed is 120 meters/minute.

Step One:

Calculate the time it will take for Mono to travel from the train to Wellington Arch and the time he will arrive at the arch.

Step Two:

Calculate the time it will take for the agents to travel from the hotel to Wellington Arch.

Step Three:

Determine the time the agents must leave in order to be at Wellington Arch at the exact time that Mono arrives.

Teacher Guide

Mission Processing Assignment

Calculate the time you and the other agents need to leave the hotel in order to intercept the suspect, Mono, as he passes underneath the Wellington Arch. You must meet him at the exact time he passes underneath the arch so that you do not draw attention. Below is information you will need to solve the problem.

- Mono will arrive on a subway train at 6:00 p.m. and begin walking toward Wellington Arch, which is 390 meters from where he steps off the train.
- Mono's walking speed is 130 meters/minute.
- Your hotel is 480 meters from Wellington Arch.
- Your walking speed is 120 meters/minute.

Step One:

Calculate the time it will take for Mono to travel from the train to Wellington Arch and the time he will arrive at the arch.

? minutes = 390 m x $\frac{1 \text{ min}}{130 \text{ m}}$ = 3 minutes travel time

Mono will arrive at 6:03 p.m.

Step Two:

Calculate the time it will take for the agents to travel from the hotel to Wellington Arch.

? minutes = 480 m x $\frac{1 \text{ min}}{120 \text{ m}}$ = 4 minutes travel time

Step Three:

Determine the time the agents must leave in order to be at Wellington Arch at the exact time that Mono arrives.

Since the suspect and the agents must arrive at Wellington Arch at 6:03 p.m., the agents must leave the hotel at 5:59 p.m. (four minutes before 6:03 p.m.)

Water Purification

INTRODUCTION

Headquarters wants to be sure that agents know water survival techniques and are able to produce their own safe water for drinking as they complete their mission in Mumbai. Agents will explore water quality and purification. They will also construct and test water treatment processes to determine how well simple processes can purify water.

time

60 minutes

handout

- *Water Purification Lab*

supplies

- "Dirty" water sample (~4 L)
- "Polluted" water sample (~2 L)
- Alum, ~200 g (2 Tbsp per group)
- Tablespoon (1 per class)
- Funnels (1 per group)
- Beakers, 400 mL; or clear plastic cups (3 per group)
- Plastic soda bottles, 2-liter (1 per group)★
- Napkins or paper towels (2–3 per group)
- Coffee filters (1 per group)
- Small gravel or aquarium rocks (natural color) (~400 mL per group)
- Sand (~400 mL per group)
- Cotton balls (8–10 per group)
- Rubber bands, small (1 per group)
- Craft sticks (1 per group)

Teacher Directions

Preparing for the Activity

- Prepare the 2-liter bottles for the lab investigation by cutting the bottles in half. The top half will form a funnel, and the bottom half will serve as a container.
- Prepare two water samples to be treated.
    - "Dirty water" for Part 1: Stir 1–2 cups of dirt into 4 liters of water. Divide the dirty water into two portions.
    - "Polluted water" for Part 2: Use about 2 liters of the dirty water and further pollute it with bits of grass and leaves, small amount of cooking oil, fruit peelings, egg shells, insoluble spices, food coloring, etc.
- Set out the alum (with a tablespoon in it) and the sand, gravel, cotton balls, and napkins/paper towels in labeled containers.

Conducting the Activity

- Familiarize agents with some of the main reasons for water pollution in India, especially in Mumbai.
    - A very large city with a very dense population.
    - Insufficient water treatment facilities
    - Release of raw sewage into bodies of water
    - Industrialization: pesticides, chemicals for fertilizers, or dyes for fabrics dumped into rivers
    - Severe organic and bacterial contamination
- Ask for suggestions of processes that could be used to help purify the water in Mumbai or in any city.
- Ask the squads to determine which segment of the procedures of the *Water Purification Lab* (Case File page 33) will be read by each agent. Allow them a minute to preview what they are to read, then have the agents in the separate squads read the procedure steps to their squads.

- Conduct a brief review of the procedure, point out the equipment and supplies they will use for each step, and model steps that might be unclear to the agents.
- In Part 1 of the lab investigation, agents will partially clean a dirty water sample by a coagulation and sedimentation process. Alum is a double sulfate of potash and aluminum, $KAl(SO_4)_2 \cdot 12H_2O$. It causes particles and foreign matter in the water to precipitate out as a gelatinous mass. It is a harmless substance that is used in making pickles. Model for agents how to fold the coffee filter to fit it into a funnel.
- In Part 2, the agents will set up a filtration system using cotton balls, paper, sand, and gravel to filter the polluted water that was prepared with "trash" particles. They will have a choice in determining how to set up the substances used in the system.
- Explain to agents how to set up and use a procedure/observation data table on Case File page 34.

Procedure	Observation
Write a brief phrase to describe the procedure. Example: "Dirty water was poured through the filter paper."	*Record everything that was noticed (e.g., odor, color, particles, gas). Example: "Water coming through filter paper is almost clear."*

Processing the Activity

- After the lab is completed, ask the agents to share what they observed during the two parts of the investigation. Conduct a class discussion on the following questions:
    - *How did the processed water compare in Parts 1 and 2?*
    - *Which sequence of filtration substances (cotton ball, paper, sand, gravel) was most effective?*
    - *Was the water safe to drink after going through these treatments? Why or why not? (Hopefully the agents will mention bacteria or other organisms that are too small to be filtered out by the processes we used. Relate this to the possibility of Dr. Vicious releasing his harmful organism into the water system.)*
- Review the types of purification steps that were used in this lab, as agents record the types and a brief description beneath the data table.
    - *Coagulation:* Adding a substance to cause pollutants to stick together
    - *Sedimentation:* Process that allows dirt and other suspended particles to settle to the bottom of the container
    - *Filtration:* Pouring water through a series of filters to take out small particles
    - *Disinfection:* Using chemicals to kill bacteria and react with other dissolved substances; this step is necessary for water to be considered safe to drink
- As a debrief, have agents respond in writing through a 3-2-1 reflection (bottom of Case File page 34).
    - 3 new words or concepts they learned
    - 2 things they found interesting
    - 1 question they still have

Adapted from "Water Filtration" by United States Environmental Protection Agency. Retrieved from https://www3.epa.gov/safewater/kids/flash/flash_filtration.html

Water Purification Lab

INTRODUCTION

Headquarters wants to be sure that all agents know water survival techniques and are able to produce their own safe water for drinking as they complete their mission in Mumbai. Therefore, this activity will explore water quality and purification. You will also construct and test water treatment processes to determine how well simple processes can purify water.

Part 1: Treating Water by Coagulation and Sedimentation

Supplies

- Beakers, 400 mL (3)
- Funnel
- Coffee filter
- Alum (2 Tbsp)
- Dirty water sample (~400 mL)
- Craft stick

Procedure

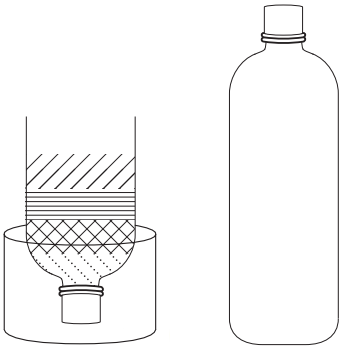
1. Obtain the dirty water sample in a beaker, stir it, and let it rest while you set up the filtration system.
2. Fold the coffee filter into a wedge-shape and fit it into the funnel.
3. Pour the dirty water through the filter paper and collect it in another beaker.
4. Divide the filtered water evenly into two beakers.
5. Add the alum to one beaker and stir well. Set the beakers aside while you set up the apparatus for Part 2 of the lab.
6. Before you start the filtration in Part 2, compare the two beakers and record your observations in the data table.

Part 2: Inventing a Filter to Clean Dirty Water

Supplies

- Cotton balls (8–10)
- Napkins (2–3)
- Gravel (~400 mL or 1 small handful)
- Sand (~400 mL or 1 small handful)
- Polluted water sample (~400 mL)
- Coffee filter
- Rubber band
- Plastic 2-liter bottle, cut in half

Procedure



1. Obtain the top and bottom of a 2-liter bottle that has been cut in half and put the top half upside down inside the lower half so that it forms a funnel.
2. Attach the coffee filter to the outside neck of the bottle with a rubber band, completely covering the hole.
3. Devise a plan to use cotton balls, sand, gravel, and napkins in the filtration setup, then put the items in place.
4. Run some tap water through the filtration setup to clean any dirt from the system. Pour the resulting water into the sink and rinse out the beaker (or bottom of the bottle).
5. Pour the polluted water through the filter, and examine the filtered water. Record the steps you took and the observations in the data table.
6. Deconstruct the filtration system carefully and examine the different materials to see how effective they were at filtering debris or dirt. Record your observations.
7. Compare the filtered water from Part 1 with the filtered water from Part 2, and record your observations.

Adapted from "Water Filtration" by United States Environmental Protection Agency. Retrieved from https://www3.epa.gov/safewater/kids/flash/flash_filtration.html